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U. S. DEPARTMENT OF AGRICULTURE.

SIXTEENTH ANNUAL REPORT

OF THE

BUREAU OF ANIMAL INDUSTRY

FOR

THE YEAR 1899.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1900.

[PUBLIC—No. 15.]

AN ACT providing for the public printing and binding and the distribution of public documents.

SEC. 73. Extra copies of documents and reports shall be printed promptly when the same shall be ready for publication, and shall be bound in paper or cloth, as directed by the Joint Committee on Printing, and shall be the number following in addition to the usual number:

Of the Report of the Bureau of Animal Industry, 30,000 copies, of which 7,000 shall be for the Senate, 14,000 for the House, and 9,000 for distribution by the Agricultural Department.

Approved, January 12, 1895.

LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., July 28, 1900.

SIR: I have the honor to submit herewith the Sixteenth Annual Report of the Bureau of Animal Industry, prepared in accordance with the organic act creating the Bureau, and recommend that it be forwarded to the Public Printer for printing.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

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SIXTEENTH ANNUAL REPORT OF THE BUREAU OF ANIMAL INDUSTRY.

REPORT OF THE CHIEF OF THE BUREAU.

INSPECTION DIVISION.

MEAT INSPECTION.

The inspection of cattle, sheep, calves, and hogs, and their products, was carried on at 138 abattoirs and packing houses in 41 cities. This was an increase of 3 abattoirs and 6 cities over the previous year, and of 10 abattoirs and 8 cities over the fiscal year 1897. In 12 of the cities where inspection was carried on last year (Chicago, Kansas City, South Omaha, Milwaukee, Sioux City, East St. Louis (National Stock Yards), St. Louis, Indianapolis, South St. Joseph, Pittsburg, South St. Paul, and Buffalo) the antemortem inspection was made in the stock yards, and included animals purchased by miscellaneous buyers and those for shipment to other cities, as well as those for local official abattoirs. The inspection of horses was conducted at one abattoir only.

The following table gives the number of inspections made upon animals before slaughter. It also shows the number rejected upon this inspection, subject to the result of the postmortem examination. The rigidity of the antemortem inspection is evidenced by the fact that upon examination at slaughter much the greater number of carcasses are pronounced fit for food. Many animals are rejected in the stock yards on account of pregnancy; these are allowed to be shipped out when desired for feeding or dairy purposes.

Antemortem inspections for fiscal year 1899.

Kind of animal.	For official abattoirs in cities where inspections were made.	For abat- toirs in other cities and miscellane- ous buyers.	Total inspections.	Rejected at abattoirs.	Rejected in stock yards.
Cattle.....	4,654,842	4,288,562	8,943,404	180	26,593
Sheep.....	5,718,464	3,819,920	9,538,384	476	18,150
Calves.....	245,859	253,404	499,263	41	3,128
Hogs.....	23,783,576	10,455,317	34,238,893	4,942	102,992
Horses.....	3,232		3,232	37	
Total.....	34,405,973	18,517,203	53,223,176	5,676	150,863

A comparison of these figures with several previous years will show how this work has progressed each year. The following table gives the total antemortem inspections for 1896 to 1899, inclusive:

Total number of antemortem inspections for four years.

Fiscal year.	Cattle.	Sheep.	Calves.	Hogs.
1896.....	7,529,523	6,318,284	314,846	21,754,826
1897.....	8,250,025	8,044,355	448,983	25,500,744
1898.....	9,228,237	10,028,287	468,199	31,610,675
1899.....	8,943,404	9,538,384	490,263	34,238,803

The number of animals inspected at time of slaughter, and the number of carcasses and parts of carcasses condemned and rendered so as to unfit them for consumption as food, are given in the following table:

Postmortem inspections for fiscal year 1899.

kind of animal.	Number of inspections.			Carcasses condemned.			
	For official abattoirs.	On animals rejected in stock yards.	Total.	For official abattoirs.	Animals rejected in stock yards.	Total.	Parts of carcasses condemned at abattoirs.
Cattle.....	4,382,020	16,726	4,398,746	6,404	3,219	9,623	10,514
Sheep.....	5,603,096	6,023	5,609,119	3,369	1,476	4,845	359
Calves.....	246,184	935	247,119	199	105	304	45
Hogs.....	23,836,943	67,096	23,904,039	48,807	6,122	55,019	29,143
Horses.....	3,232		3,232	181		181	
Total.....	34,071,475	91,680	34,163,155	59,050	10,922	69,972	40,061

In addition to the condemnations upon regular inspection, as above given, there were 41,597 carcasses of hogs condemned upon microscopic examination for trichinæ. In accordance with the provisions of section 22 of the regulations governing meat inspection, about half of the meat from these carcasses was cooked, the rest being tanked.

For the purpose of comparison the following table is given:

Number of animals inspected before slaughter for abattoirs having inspection, 1891-1899.

Fiscal year.	Cattle.	Calves.	Sheep.	Hogs.	Horses.	Total.
1891.....	83,891					83,891
1892.....	3,167,069	59,089	583,361			3,809,459
1893.....	3,922,174	92,947	870,512			4,885,633
1894.....	3,862,111	96,331	1,020,764	7,964,850		12,944,056
1895.....	3,732,111	109,941	1,344,031	13,576,917		18,783,000
1896.....	4,050,011	213,575	4,710,190	14,301,963		23,275,739
1897.....	4,289,053	259,090	5,179,643	16,813,181		26,541,812
1898.....	4,552,919	241,092	5,700,092	20,713,863		31,213,966
1899.....	4,654,842	245,859	5,718,464	23,783,576	3,232	34,405,973

The number of animals that died of disease or injury, or were killed by city inspectors after rejection in the stock yards, added to those found dead in cars or pens at abattoirs and tanked, is shown in the table following:

Number of different kinds of animals rejected for fiscal year 1899.

Manner of death.	Cattle.	Sheep.	Calves.	Hogs.	Horses.	Total.
Dead at abattoirs	235	1,059	36	19,424	43	20,797
Died in stock yards	309	1,121	105	2,201	.....	3,736
Killed in stock yards	1,296	784	176	21,274	.....	23,530
Total	1,840	2,964	317	42,899	43	48,063

Tag or brand affixed.—The meat-inspection tag or brand was affixed to 14,919,664 quarters and 217,920 pieces of beef, 5,522,142 carcasses of sheep, 225,348 carcasses of calves, 932,878 carcasses of hogs, and 551,331 sacks of pork.

Packages stamped.—The number of packages stamped comprised 4,840,834 of beef products, 9,417 of mutton, 12,545,965 of hog products, and 763 of horseflesh. The number of packages of hog products just given includes 393,838 packages which contained meat that had been microscopically examined in addition to the regular inspection.

Cars sealed.—The number of cars sealed which contained inspected meat for shipment to packing houses and other places was 47,455.

Certificates issued.—The number of certificates issued for meat products which had received the regular inspection, exclusive of horseflesh, was 42,237. The exports thus certified consisted of 1,428,290 quarters, 45,789 pieces, and 837,634 packages of beef, weighing 360,843,856 pounds; 9,417 packages of mutton, weighing 525,705 pounds; 109,505 carcasses and 880,324 packages of pork, weighing 278,696,435 pounds. Fourteen certificates were issued for 763 packages of horseflesh, weighing 347,048 pounds.

Cost of inspection.—The cost of this part of the work of the inspection division was \$465,709.23, which, embracing all the branches of meat inspection, makes an average of 0.88 cent for each of the 53,223,176 antemortem inspections.

The following statement shows the cost of each antemortem inspection from 1893 to 1899, inclusive:

	Cents.
1893	4.75
1894	1.75
1895	1.10
1896 .....	.95
1897 .....	.91
1898 .....	.80
1899 .....	.88

MICROSCOPIC INSPECTION OF PORK.

The number of carcasses examined was 2,227,740. The result of the examination was: Class A, free from all appearance of trichinæ, 2,160,230, or 96.97 per cent; Class B, containing trichina-like bodies or disintegrated trichinæ, 25,913, or 1.16 per cent; Class C, containing living trichinæ, 41,597, or 1.87 per cent.

The number of certificates issued for microscopically examined pork products was 22,708. The number of packages exported was 393,626, weighing 108,928,195 pounds. Of this quantity, 137 packages, weighing 70,046 pounds, went to countries not requiring a certificate of microscopic inspection.

The cost of the microscopic inspection was \$198,355.14, an average of 8.9 cents for each carcass examined and of 0.182 cent for each pound exported.

The apparent increase in the cost over last year is due in some measure to the necessity of increasing the force in order to maintain a more careful control of the stock of microscopic meats and of the cellars containing it, and to a more accurate system of charging employees to different accounts according to the kind of work performed, whereby a number of salaries which have heretofore been charged to general meat inspection have more properly been counted as part of the expense of the microscopic inspection.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

The year shows a considerable falling off in the number of domestic animals exported to Europe. In the table following are given the number of inspections of American and Canadian cattle and sheep for export, the number rejected, the number of American cattle tagged, and the number of animals exported under the supervision of inspectors of this Bureau:

Number of inspections, etc., of American and Canadian farm animals.

Kind of animal.	American.				Canadian.		
	Inspections.	Rejected.	Tagged.	Exported.	Inspected.	Rejected.	Exported.
Cattle.....	643,301	1,593	327,741	<i>a</i> 311,595	27,806	9	27,797
Sheep.....	174,717	118	-----	<i>b</i> 98,551	37,247	41	37,206
Horses.....	-----	-----	-----	36,351	-----	-----	2,685
Hogs.....	-----	-----	-----	98	-----	-----	-----

a 14,786 from Chicago via Canadian ports.

b 4,757 from Chicago via Canadian ports.

The number of certificates issued for American cattle was 1,201. The number of clearances of vessels carrying live stock that had been inspected was 852.

The following table shows the number of animals inspected at time of landing by the inspectors of this Bureau stationed at the ports of

London, Liverpool, and Glasgow, together with the number and percentage lost in transit:

Number of animals inspected at time of landing in London, Liverpool, and Glasgow, and loss in transit.

From—	Cattle.			Sheep.			Horses.		
	Landed.	Lost.		Landed.	Lost.		Landed.	Lost.	
	Number.	Number.	P. ct.	Number.	Number.	P. ct.	Number.	Number.	P. ct.
United States	294,318	911	0.31	97,659	1,526	1.54	20,035	224	1.11
Canada	24,295	a 504	2.03	34,003	a 1,639	4.6	1,808	5	0.28
Totals, etc	318,613	1,415	0.44	131,662	3,165	2.35	21,843	229	1.04

a 366 cattle and 441 sheep were lost by shipwreck.

The expense of inspection of animals for export, the supervision of the movement of Southern cattle, and the inspection of animals imported from Mexico amounted to \$107,023.41. Following the precedent of estimating half of this to be properly chargeable to the export work, we find that the cost of inspecting the 410,146 domestic cattle and sheep exported was \$53,511.70, an average of 13 cents per head. The number of inspections of these animals in this country was 818,018, and in Great Britain 391,977, a total of 1,209,995, made at an average cost of 4.42 cents for each inspection.

SOUTHERN CATTLE INSPECTION.

During the quarantine season of 1898, 32,937 cars, containing 911,455 cattle from the area infected with splenic fever of cattle, were unloaded in the quarantine divisions of the stock yards at different points. There were 33,814 cars cleaned and disinfected.

In the noninfected area in Texas 236,369 cattle were inspected and identified by brands as originating north of the quarantine line and permitted to be removed to other States for grazing. In California 37,832 cattle were inspected prior to shipment to points outside of the infected district. In conjunction with the authorities of Missouri 684 cattle originating in the northern counties of Arkansas were inspected and permitted to be driven into Missouri.

PREVENTION OF SCABIES.

In order to prevent the spread of scabies among sheep, it was required that all sheep shipped from stock yards to other States for feeding purposes be dipped with some preparation that would kill the parasite. In pursuance of this order there were dipped 145,974 sheep that were infected and 526,970 that had been exposed to the contagion of the disease.

For many years the parasitic disease of sheep popularly called scab has been prevalent, especially in some of the Western States and

Territories. Diseased sheep have been shipped in violation of the law, and stock yards and stock cars have been almost constantly infected. The result has been that sheep could not be purchased for feeding purposes in any of the markets of the country without danger of bringing the contagion to the farm with them.

Not only does sheep scab always damage and often destroy the fleece, but it so reduces the strength of the affected animals that they fall an easy prey to internal parasites or succumb to unfavorable conditions of food and surroundings. Congress has specifically referred to this disease in the appropriation act as one which the Department is authorized to control by sanitary regulations.

The first step taken by the Department looking to the limitation and control of this disease was by a circular letter notifying transportation companies and shippers of the existence of the contagion and pointing out the prohibition of shipment and penalty provided by the law. Subsequently an order was issued that diseased sheep discovered by the inspectors in transit or in infected yards should be detained and dipped before going on to destination.

The effect of these orders was to protect purchasers of store sheep and to lessen the number of diseased animals sent to market. It was found, however, that some of the dips used by stock-yards companies and sheep owners were not efficacious, and that others were so severe or poisonous as to be dangerous. An order has consequently been issued specifying the kinds of dips which would be recognized and the manner in which they should be prepared and applied.

The effect of these measures has been extremely satisfactory. The inconvenience of detention and the expense of dipping have had the effect of lessening the number of diseased sheep sent to market, and has led to active efforts to cure them on the farm or ranch before shipping. This has been accomplished without putting the shippers of healthy sheep to any inconvenience or expense unless these animals were going to farms from infected stock yards. The indications are at this writing that it will soon be possible to make the stock cars, the central stock yards, and other channels of interstate commerce safe and free from infection, in which case store sheep could be purchased in the markets without danger of infection, and only diseased sheep would come under the restrictions.

INSPECTION OF IMPORTED ANIMALS.

The inspection of animals imported from Mexico was made at the ports of entry along the boundary line, and included 79,908 cattle, 1,254 sheep, 64 swine, and 121 goats.

The imports from Canada of animals not subject to quarantine detention consisted of 90,468 cattle, 172,985 sheep, 1,769 horses, 194 hogs, 1 moose, 1 goat, and 11 mules. Of these, 425 cattle, 6,581 sheep, and 176 hogs were for breeding purposes.

Following is a statement of the number of animals imported and held at the different quarantine stations for the prescribed period:

Number of animals imported and quarantined at different stations.

Stations.	Cattle.	Sheep.	Hogs.
Littleton, Mass.....	8	93	
Garfield, N. J.....	335	405	45
St. Denis, Md.....	6		1
Houlton, Me.....	483	315	2
Vanceboro, Me.....	112	13	
Eastport, Me.....	5		
Newport, Vt.....	241		
Island Pond, Vt.....	71	9	1
Beechers Falls, Vt.....	19	5	
Richford, Vt.....	43		
St. Albans, Vt.....	37		
Ogdensburg, N. Y.....	43		
Cape Vincent, N. Y.....	78		
Buffalo, N. Y.....	38		
Port Huron, Mich.....	43		
Total.....	1,582	840	49

There were also at the Garfield station 12 camels, making a total of 2,463 animals quarantined.

PATHOLOGICAL DIVISION.

BLACKLEG INVESTIGATIONS.

The item of work which has consumed the most time in the pathological division has been the distribution of blackleg vaccine, including its preparation, shipment, and the correspondence incident thereto. During the year 6,200 letters on this subject were received, each of which required a reply and an application blank for vaccine. On return of the blanks properly filled up, vaccine was forwarded and the applications properly indexed and filed. In many instances it was necessary to dictate special letters in reply to inquiries. Vaccine was sent out to the number of 545,289 doses. The following statement shows the number of doses shipped for each month of the year:

July.....	19,555
August.....	26,305
September.....	3,820
October.....	47,487
November.....	69,365
December.....	68,260
January.....	50,629
February.....	41,145
March.....	29,823
April.....	89,675
May.....	44,670
June.....	54,655
Total.....	545,289

The comparatively small amount sent out in September was due to the fact that the supply was exhausted at that time. The more than half a million doses were sent principally into the States of Texas, Nebraska, Kansas, Colorado, North Dakota, New Mexico, South Dakota, and Indian Territory and Oklahoma Territory. Outbreaks of blackleg have occurred elsewhere, however, being reported from Virginia, West Virginia, Pennsylvania, Vermont, New York, Ohio, Kentucky, Tennessee, North Carolina, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Washington, Wyoming, Montana, Oregon, Idaho, Utah, California, Arkansas, and Arizona. It appears, therefore, that this disease may prevail in any section in which cattle raising is an extensive industry.

Dr. Victor A. Nörsgaard, chief of the pathological division, has published an article in the annual report of this Bureau for 1898 on "Blackleg in the United States and the distribution of vaccine by the Bureau of Animal Industry," which gives a résumé of the work so far accomplished by the Bureau, the history of the disease in this country and in Europe, and the geographical distribution of the disease in the United States. Dr. Nörsgaard estimates that the annual loss of cattle from blackleg in the districts principally affected has ranged in years when the disease was most prevalent from 5 to 35 per cent. The estimated loss after inoculation with the Bureau vaccine was 0.54 per cent inoculated, or a little more than one-half of 1 per cent. This percentage would have been still further reduced, no doubt, had the operators been familiar with the work of vaccination. In fact, the reports received state that losses, when they occurred, were due to failure to follow instructions carefully. This rather remarkable record indicates the perfect safety of the method pursued when the fact is known that nearly all the inoculations were made by inexperienced persons.

The distribution of vaccine is being continued by the Bureau, and adequate measures have been taken to permit the sending of the vaccine immediately on receipt of the application. It is advisable that all stock owners in infected districts should vaccinate their young stock regularly, without awaiting an outbreak of the disease, as heavy losses may be sustained in the course of a few days. The Bureau can not, however, undertake to keep stockmen supplied with vaccine simply for the purpose of keeping it on hand for use in case of an outbreak.

TEXAS FEVER.

It is a matter of congratulation that the method of producing immunity from Texas fever by inoculating with the blood of immune animals, as first practiced and proved efficacious by this Bureau, has been used practically with highly satisfactory results by the State Agricultural Experiment Station of Missouri. That station has very properly taken the matter up and has permitted its veterinarian to

make the inoculations as a means of insuring the safety of pure-bred stock from Missouri sold for improving the herds in the Texas fever district. The losses from the operation are understood to be insignificant, and the inoculated animals have been able to resist almost perfectly the effects of exposure to the contagion after their arrival in the infected district. The practical application of this discovery is of great importance, both to the breeders of improved stock in the more Northern States and to the cattle raisers of the infected district. It permits the improvement of the Southern herds without the discouraging losses which have heretofore always occurred, and no doubt it will lead to the rapid grading up of the cattle of the South and Southwest, increasing materially the numbers and values.

THE TEXAS FEVER TICK IN THE WEST INDIES.

The new and more intimate relations which have been established between the United States and some of the islands of the West Indies have led to the inquiry as to whether these islands are permanently infected with Texas fever, as is the southern portion of the United States and the coast regions of Mexico. Information received from Jamaica has long since led to the conclusion that that island is permanently infected. The large numbers of cattle taken to Cuba from the infected districts of the United States, Mexico, Central America, and South America have unquestionably infected the larger part of the island, even if it had previously been free, which is unlikely.

Reports from Porto Rico indicated that but a comparatively small number of cattle have recently been imported, and the quality of some of the native cattle seemed to favor the assumption that the fever contagion had not been introduced. To determine this, an inspector of the Bureau, Dr. Rice P. Steddom, was instructed to proceed to Porto Rico and make a careful investigation. Dr. Steddom traversed a large portion of the island and found the cattle everywhere infested with the *Boophilus bovis* tick, the presence of which in the United States is prima facie evidence of infection with Texas fever. When the offspring of the Porto Rican ticks were placed upon cattle at our experiment station, however, no disease was produced. The question therefore is still unsettled as to whether the Pyrosoma, the true contagion of the disease, exists in Porto Rico. It is well known that the *Boophilus* acts only as the carrier of the Pyrosoma, and that the former may exist in a district without the latter, and, conversely, the latter may exist without the former. It is only when both are present that the disease exists in a contagious form. The importance to the cattle raisers of the island of having this question speedily and definitely determined is apparent. If the Pyrosoma does not exist there, measures should at once be adopted to prevent its entrance. The tick being certainly prevalent, the introduction of a single cow

or steer bearing the *Pyrosoma* might convert these comparatively harmless parasites into the most deadly scourges of the bovine race.

GLANDERS.

Four cases of glanders occurring within the District of Columbia and one from Wyoming were diagnosed in this division. In November Drs. A. D. Melvin and V. A. Nørgaard investigated an outbreak among the Army horses at Jacksonville, Fla. A report was made to Maj. Noble H. Creager, quartermaster, embodying recommendations such as are required for the eradication of the disease.

RABIES.

Inoculations of rabbits from sixteen suspected rabid dogs showed ten cases of rabies in the District of Columbia as coming under the notice of the division. Another case came from South Carolina. In two of the cases diagnosed, four persons were reported to have been bitten by the dogs affected. The method of diagnosis employed in these cases is given in an article which appeared in the volume comprising the Twelfth and Thirteenth Annual Reports of this Bureau.

INFECTIOUS LEUKÆMIA IN FOWLS.

Several outbreaks of infectious leukæmia in fowls were investigated. One case was from Virginia and another from Wisconsin, thus showing the widespread distribution of the disease. This is a bacterial disease, and is frequently mistaken for fowl cholera. Investigations concerning this disease have been reported quite fully by Dr. Veranus A. Moore, in the Twelfth and Thirteenth Annual Reports of this Bureau, and further information is contained in Bulletin No. 8 of the Bureau, and in the Fifteenth Annual Report.

ASTHENIA IN FOWLS.

Asthenia in fowls, sometimes called "going light," is discussed by Dr. Charles F. Dawson, in the Fifteenth Annual Report of the Bureau. Dr. Dawson believes he has discovered the cause of the disease to be a bacterium which he has described and named *Bacterium astheniæ*. During the year two outbreaks were investigated, one in fowls and the other in pigeons.

WILD UND RINDERSEUCHE.

During the past summer an outbreak of a disease supposed to be identical with the Wild und Rinderseuche of Germany was reported from Tennessee. The Bureau directed Dr. John R. Mohler to proceed to the seat of the outbreak and investigate the cases. His investigations gave no evidence of the presence of this contagious European disease.

MISCELLANEOUS WORK.

Specimens for diagnosis.—Many specimens are received annually at the laboratory from various sources. During the past year the following diagnoses were made: Melanosis, pneumonia, actinomycosis, tuberculosis, hog cholera, enteritis, blackleg, Texas fever, osteosarcoma, lipoma, fibro-lipoma, and adeno-carcinoma. Each of these specimens requires much laboratory work with the microscope, sometimes a week being devoted to a single specimen; in each case also a careful record is made and full reply returned to the sender.

Bacterial cultures.—A collection of about fifty species of bacteria has been maintained, and quite a number of cultivations made from them have been prepared and sent to scientific schools and colleges upon request. This is one of the Bureau's means of disseminating information, and appears to be much appreciated.

Special students.—During the year two gentlemen have taken courses of special instruction in the laboratory of the pathological division, namely, Prof. L. L. Lewis, of the Oklahoma experiment station, who has studied the preparation and use of blackleg vaccine, and Prof. E. F. Pernot, bacteriologist of the Oregon experiment station, who has had opportunities for instruction in most of the lines of work pursued in this division. The Bureau furnishes equipment and has facilities for such work which it is difficult to find elsewhere in this country. The benefit which the Bureau may in this way render to the country at large is obvious.

Increased facilities.—The laboratory building has been enlarged during the year, affording two new rooms, which have been much needed. One of these will be devoted to histological research and the other to the preparation of blackleg vaccine.

BIOCHEMIC DIVISION.

TUBERCULIN AND MALLEIN.

The routine work in the preparation of tuberculin and mallein has continued during the past year. These products are furnished only to local authorities for official use. The quantity of mallein sent out to State officials and experiment stations has been sufficient to test about 5,200 animals. The quantity of tuberculin sent out during the year was sufficient to test about 36,000 animals.

STAMPING INK.

In addition to other work this division has continued to prepare and supply ink suitable for stamping meat in such quantities as required by the inspection division.

SERUM FOR HOG CHOLERA AND SWINE PLAGUE.

The work of preparing serum for treating the diseases of hog cholera and swine plague has been conducted on a very much larger scale

than last year. The results of last season's work were exceedingly satisfactory, and the number which would serve as a source of serum has been largely increased. During the present year a force of inspectors has been at work in four counties in Iowa treating a large number of animals and endeavoring to keep down, so far as possible, by the serum treatment, the amount of disease among the swine. While it is impossible at the present time to give positive results in connection with this work, it appears from the reports that have been sent in that we may expect about the same results as those obtained in Page County, Iowa, during the past year.

The work in connection with the preparation of antitoxin in such large quantities has been very heavy, both in the laboratory and at the experiment station of the Bureau. It requires a considerable number of employees to prepare the necessary cultures which are to be used in injecting the animals, to draw the serum, have it properly bottled and shipped, and at the same time to control the outbreaks in the West. Cultures are taken from each herd that is treated in the West when an autopsy is made upon some of the sick animals. These cultures are examined and tested. In addition, specimens of serum from each herd are used for the application of the motility test, and every care is taken to demonstrate so far as possible the exact character of the disease which exists in the herds that are being treated. Many problems of scientific interest have arisen in connection with this work, the elucidation of some of which will be of great practical importance. So far as possible, investigations of these points have been made as the routine work was progressing, or a careful note taken of them, and they will receive more careful study when the routine work of the laboratory will permit and when increased assistance has been secured.

MISCELLANEOUS WORK.

Some examinations of butter, from a hygienic standpoint, have been made for the dairy division, and also other miscellaneous investigations, as the work of the Bureau demanded.

INTERNATIONAL TUBERCULOSIS CONGRESS.

As the general study of the diseases of men and animals progresses it becomes more and more evident that the final solution of many difficulties depends upon a careful biochemic study of diseases. This appears to be the case, not only with the diseases which the division has been studying for some years, but also with Texas fever, diseases of fowls, and many other diseases. The very intimate relationship which exists between the diseases of men and animals, and the dangers to which animals may be subjected from like diseases of men, deserve very special investigation. For this reason, in May last, the chief of the biochemic division was sent to Berlin for the purpose of

attending the International Tuberculosis Congress. Over two hundred prominent men were present at this congress as delegates from twenty-five nations. The Congress was under the patronage of the Empress of Germany, and there were more than two thousand members. The papers presented by many of the most prominent men in all lines of medical, bacteriological, and hygienic work were exhaustive in character, reviewing very thoroughly the knowledge of tuberculosis from all standpoints at the present time. They will serve as an excellent basis for continued investigation and work in the future. Papers by Virchow, Bollinger, and others emphasize the dangers of meat and milk from tuberculous animals. It appears that indirectly very many practical results for the benefit both of men and animals will follow from the work of this congress.

As it was the fortune of the chief of the biochemic division to meet at that congress, and afterwards in visiting the most important anti-toxic serum laboratories and stations in Europe, the most prominent workers in biochemic lines, it seems right that attention should here be called to the high regard in which he found the scientific work of the Bureau of Animal Industry to be held by investigators in similar lines in the different European states. It is a great advantage to the work of the Bureau and the Department to have its scientific employees meet personally the investigators in similar lines, thus affording the opportunity of exchange of ideas and the planning of cooperative work.

PROPOSED WORK FOR NEXT YEAR.

For the next year it is proposed to continue in the biochemic division the routine work which has already been referred to, and, in addition, to take up as many new problems as the laboratory facilities and the number of assistants at work will allow. In connection with this routine work it will be necessary for the division to examine numerous samples of dips used for treating diseased sheep that are subjects of interstate commerce in order to ascertain if these dips have a satisfactory percentage of active ingredients to be recognized as efficient remedies.

Insecticides and germicides.—The chief of the biochemic division has also been appointed as reporter on insecticides and germicides by the Association of Official Agricultural Chemists. His efforts in this work will be to suggest such methods for the examination of insecticides and germicides as will be thoroughly reliable and serve to indicate their actual value.

THE EXPERIMENT STATION OF THE BUREAU.

PRODUCTION OF HOG CHOLERA AND SWINE PLAGUE SERUM.

Investigations relative to the production of hog cholera and swine plague serum have been continued at the experiment station of the

Bureau. The results obtained in the past from serum prepared by the station, working in conjunction with the biochemic division, have afforded much encouragement and have justified the continuation of the work on a much larger scale. The attempt is being made to produce a sufficient amount of antitoxic serum to treat all the hogs affected with or exposed to hog cholera or swine plague in a territory embracing four counties specially selected for experimental work, so that the final deductions concerning the value of the serum treatment for these diseases may leave no room for adverse criticism.

The portion of this work assigned to the experiment station consisted in the selection of proper animals for supplying the serum, and also the care, preparation, and treatment of these animals throughout the course of the experiment. A thorough effort is being made to find the species of animal best adapted to furnish this serum, and also the best method of administering the cultures of bacteria and the products of cultures to give the serum of the animals an antitoxic value. It is also designed to find the best and least expensive treatment of the unfavorable conditions which frequently follow the injection of cultures of disease-producing bacteria. Cultures of various ages, in combination with a variety of drugs and under a variety of conditions, have been used, and always with one object in view, namely, to obtain the most active antitoxic serum at the least possible cost and with the least inconvenience to the animal supplying it.

While the treatment of hog cholera and swine plague with antitoxic serum has proved to be of great value, and further investigations along this line will be made, the possibility that a method may be discovered by which these two important diseases can be treated successfully without the intervention of a serum animal has not been overlooked. Experiments in this direction are now being made, and while they have so far given no very encouraging results, it is desirable that they should be continued.

ANTITOXIC SERUM FOR TUBERCULOSIS.

Experiments to produce an antitoxic serum for the treatment and prevention of tuberculosis are also in progress, the work being done by the station in cooperation with the biochemic division.

TEXAS FEVER INVESTIGATIONS.

Much time and attention has been given to the Texas fever question. It is desirable that the method developed by the Bureau for immunizing Northern cattle which are to be shipped into the South should be improved. The same observation is true of the dips now in use for destroying ticks (*Boophilus bovis*) on Southern cattle.

The immunizing feature has been undertaken by studying the effects produced by the injection of blood serum from Southern cattle into Northern cattle. Much remains to be done in this line. The

seeming difference in severity of the infection produced by the injection of blood obtained from different Southern cattle and the difference existing between the virulence of Texas fever in different portions of the so-called permanently infected areas are conditions requiring investigation.

The importance of discovering a dipping mixture through which Southern cattle may be passed to kill the ticks upon them and thus remove the danger of spreading Texas fever has not been lost sight of, but unfortunately all mixtures used have proved inefficient. A number of different dips are now being tested at the station, and the effects produced on both the cattle and the ticks are carefully noted. Laboratory tests are also being made, and there is still reason to believe that success will eventually be attained.

A lot of cattle ticks from Porto Rico were tested to determine whether they carried the infection of Texas fever, but a negative result was given. The ticks were found to be in all respects like our native cattle tick, with the exception that our ticks are a trifle larger and a little more oval (less circular) in outline.

PREPARATION OF BLACKLEG MEAT.

During the early portion of the year a considerable amount of blackleg meat was prepared at the station to be used by the pathological division in the manufacture of blackleg vaccine. Much of this vaccine was subsequently tested at the station.

OUTBREAK OF TETANUS.

During the latter part of the year the station suffered an outbreak of tetanus, or lockjaw. The infection was confined entirely to the animals used in serum experiments. This unhappy circumstance was turned to the best advantage by using it as an opportunity to test the value of serum treatment as applied to lockjaw. All the animals which had been exposed to the disease were injected with an immunizing dose of tetanus antitoxic serum, and the animals already affected were also treated with the serum. Among the animals which received an immunizing dose (horses, mules, donkeys, and cattle, over 100 in all), only one subsequently suffered with tetanus. This animal became affected within thirty-six hours after the serum was injected. It was a donkey, and was probably affected at the time the injection was made, and hence derived no benefit from the serum. The treatment of tetanus, or lockjaw, once the symptoms are well developed, either by hypodermic or introcranial injections of serum, accompanied by large doses of chloral, morphine, or chloroform inhalations, merely serve to prolong life a few days. Treatment of the wound through which the tetanus bacillus gained entrance to the body was almost out of the question, because of the difficulty of locating the wound. In only one instance was the injection of material from the suspected

seat of infection into a rabbit followed by a transmission of the disease. From this it is to be concluded that it would be wise for the experiment station to be provided with two or three tetanus antitoxic serum animals, to guard against further losses from the disease, and also to determine whether a serum of sufficient strength can be produced to have a positive value as a curative agent.

During the past two years the experiment station has labored under some disadvantages. Two years ago the location of the station was changed to its present site, and in addition to the regular routine and special scientific work there was added the work of planning and, in a great measure, constructing the numerous equipments and appliances which are essential to the class of investigations which are being conducted. The year ended in a very gratifying manner, with the purchase of the property now used for this station, and hereafter it will not be necessary to abandon improvements and build anew on account of the expiration of a lease. This is a great encouragement to those engaged in the scientific work.

DAIRY DIVISION.

COLLECTING AND DISSEMINATING INFORMATION.

A general survey of the condition of the dairy industry of the country at large was begun upon the organization of the division. This has been continued and special inquiries have been made in some branches, as, for example, the milk supply of cities and towns. Some reports have been printed and others are in hand awaiting revision and publication.

The division continues to collect dairy data in general, with a view to its proper arrangement and further use. So far as the clerical force of the office permits, the material collected has been indexed for ready reference. This particular work, however, is always much in arrears.

The current correspondence, with calls for specific information, together with other routine work of the office, is continuously increasing. This includes the preparation of reports and other manuscript for publication.

During the year five distinct publications have been prepared in the division, comprising in all 136 pages. Of these, two are included in the Fifteenth Annual Report of the Bureau, one of which was ordered to be revised and issued as a Farmers' Bulletin. Former publications of the division have been so much called for as to necessitate some revision and the reprinting of large editions.

VISITING DAIRY CENTERS.

The practice of visiting dairy centers and attending the annual conventions of State dairy associations and similar bodies has been

continued so far as the home duties of the chief and assistant chief of the division have permitted. In order to extend this service, in accordance with the policy of the Department, special agents were temporarily employed. Messrs. John H. Monrad and D. W. Willson, both of Illinois, served in this capacity. In all, twenty States have thus been visited by representatives of this branch of the Department. In this way hundreds of men actively engaged in the dairy industry have been met and consulted in different parts of the country and personal relations established which will be of material benefit in future work.

EXPERIMENTAL EXPORTS OF BUTTER.

Under authority given in the annual appropriation act of Congress for this Department, and the special provision made therein for the purpose, this division has had the supervision of a series of experimental exports of butter and cheese. This has been in continuation of the work of 1897-98, as already reported, but upon a plan enlarged and diversified. In this connection special agents of the Department have visited Great Britain, France, Germany, China, Japan, the Hawaiian Islands, and the Philippine Islands, and made arrangements for experimental exports to places in all these sections of the globe.

Trial shipments to Germany and France demonstrated that the markets for choice dairy products from America were by no means as good in those countries as in Great Britain, while the difficulties in transportation and the import duties imposed added to the disadvantages experienced. Accordingly, the experimental exports, made almost every week during the year 1898 and weekly until the summer of 1899, were confined to England, and mainly to the market of Manchester. The desired information having been obtained by these experiments, extending through the greater part of three years, they were discontinued in May, 1899. Then work was immediately begun upon similar exports from San Francisco to Pacific ports. No results from the latter can yet be reported.

The series of weekly experimental exports of selected creamery butter to Manchester, England, for more than a year, was highly satisfactory. A group of retail merchants in the north of England was thus supplied regularly with this grade of butter from the United States, so that they had it continually on hand for their customers. The result was that a good reputation was well established for American butter in that district, and the merchants, during the latter part of the trials, urged the shipment of larger quantities. Excepting an occasional variation from the standard and a few instances of deterioration incident to imperfections in the facilities for transportation, this butter was eminently satisfactory to the merchants and consumers, and replaced Danish butter of first quality, which had been previously used. It was commonly retailed at the price of the best

Danish, although the merchants demanded a slight concession in what they paid as an inducement to take the American article instead of the standard product of Denmark and Sweden, to which they had so long been accustomed. When the experimental shipments were discontinued, the Manchester receivers expressed great disappointment, saying that the United States creamery butter had then made such a place for itself in their market and was so regularly in demand by the retailers that they desired to continue their supply. Application was accordingly made for the addresses of large creameries, or their selling agents, from whom fine butter in quantity could be obtained. British merchants subsequently made offers directly to manufacturers in this country for large quantities, and the only question about extending this trade was the relative prices of the highest grade of butter on the two sides of the Atlantic.

During the fiscal year covered by this report the domestic markets of the United States offered such prices for all the butter product of high grade of this country as to preclude exports upon a commercial basis. The details in connection with these experimental exports to Great Britain during the fiscal year 1898-99, and which included cheese and eggs, as well as butter, will be made the subject of a special report by the dairy division.

PROPOSED WORK FOR NEXT YEAR.

The work of the dairy division for the fiscal year 1899-1900 is expected to include a continuation of the different lines of effort above reported.

The experimental exports will require a large share of the attention of the working force and probably necessitate the employment of a special agent on the Pacific coast. Exports to Pacific ports, although less frequent than those to England, will involve much detail and a much longer time for obtaining results.

Refrigerated transportation can not be furnished by the steamship lines on the Pacific, and this may not be desirable at present, as cold storage is not to be found at most of the Oriental markets. It will be necessary, therefore, to send all butter, and perhaps cheese also, as well as canned and condensed milk and cream, in hermetically sealed packages, capable of preserving their contents during long voyages and in hot climates.

The art of canning butter so that it will remain in good condition for months, and when subjected to great changes of temperature, has not yet been brought to perfection in this country. Incidentally it is desirable to give considerable attention to this subject for the benefit of exporters and those who wish to prepare butter for export to markets in warm countries.

An obstacle to successful competition in this trade is the fact, well established, that butter made in some other countries and found in

the new markets referred to has a firmer body and higher melting point and consequently "stands up" better when the packages are opened than that which is made in the United States. Investigations show that certain feeding materials for cows have a specific effect upon the hardness of butter made from their milk. More definite information on this subject is needed, however, and it is hoped that this division may, by cooperation with agricultural experiment stations and otherwise, do something toward determining the particular kinds of food which are available in different parts of the country and which can be depended upon to regulate, to a considerable degree, the composition of the butter fat in milk, and hence the texture of butter.

Besides experimental exports in which the dairy industry of the Pacific coast should be particularly interested, it is proposed to ascertain the prospects for extended trade in dairy products in Mexico, the West Indies, and South America.

Through the courteous cooperation of the State Department a general inquiry has been undertaken, with a view to learning more than is now accurately known as to the production, consumption, and commerce of dairy products in all parts of the world.

Under instructions which have been issued, the chief of the dairy division will procure and superintend the arrangement and display of suitable material for a collective exhibit of the dairy industry of the United States at the Paris Exposition of 1900.

LABORATORY FACILITIES.

For a number of years the laboratories of the Bureau have been located in a rented building, giving insufficient space and exposing all the valuable material to danger of destruction by fire. In May last the owner of this building consented to erect an addition, which has increased the facilities of the laboratories materially. The increasing demands for laboratory work, and the constant accumulation of specimens, card indexes of literature, apparatus, etc., make it extremely desirable that a laboratory building should be erected upon the Department grounds especially adapted to the needs of this Bureau. As an example of the importance of a fireproof building, it may be stated, the zoologist of the Bureau in his studies of animal parasites found the classification of many of them so defective that it was impossible to tell with what species the European investigators had been working. The life history of the organisms and the remedial measures required were uncertain, and the whole subject was in confusion. In order to obtain a basis for satisfactory work it was necessary to obtain from the various museums of the world the type specimens from which the original descriptions of species were made. Some of these specimens were more than a century old, and it is plain that if they should be destroyed by the burning of the laboratory

they could never be replaced. Their loss would be not only a loss to this country but to the world. It does not appear to be right to imperil such material, and yet it must be brought to our laboratory and used if we are to make progress in the study of these numerous forms of life which constitute one of the factors that must be considered in the successful development of our animal industry.

Again, the card indexes which we now possess relative to the literature of the world concerning diseases and parasites of animals have been in preparation for at least a decade and are now very perfect. These are necessary to creditable scientific work, because no man can make satisfactory researches without knowing what has already been done in the same line. If these indexes should be destroyed they could not be replaced except by the same slow and tedious process by which they have been built up. A fire in the laboratory would therefore mean an enormous loss of time and a most discouraging interruption of the scientific work.

I would therefore most earnestly recommend that this matter be presented to Congress, with an appeal for early action, to secure such laboratory facilities as are commensurate with the great work of this Department in behalf of the agricultural industry.

The laboratory of this Bureau has not been in any sense a drain upon the resources of the country, but has, in addition to its scientific investigations, furnished products, such as tuberculin, mallein, black-leg vaccine, and hog cholera serum of a value far beyond the total expenses incurred. These products have either been furnished to State authorities as the best available means of cooperation for the control of contagious diseases, or they have been used in the service as a method of eradicating or curing such maladies. Considering the expenditures that are now made for rent, the safety of Government property and material, and the increase of work that could be accomplished with better facilities, it would appear that such a building as is referred to would be from all points of view a most desirable acquisition.

SPECIAL RECOMMENDATIONS FOR 1900-1901.

The following recommendations are respectfully made:

(1) That the meat inspection force be increased until all the meat which is shipped from one State or Territory to another or to a foreign country is thoroughly inspected. At present there are numerous applications for inspection which can not be favorably acted upon on account of the insufficiency of the appropriation.

(2) That measures for excluding sheep affected with scab from the channels of interstate commerce be rigidly enforced. This disease is a very annoying one, causing heavy losses to the sheep raisers, and has been largely spread through interstate shipments. Infected yards and cars should be disinfected; diseased sheep in transit should be quarantined and either slaughtered at once or dipped in a reliable

mixture before being allowed to proceed. Sheep scab, although a very injurious disease, is easily cured and should be eradicated from the United States, as it has been from Australia.

(3) That the distribution of blackleg vaccine be continued a sufficient time to determine whether the prevalence of the contagion is lessened by the systematic vaccination of the cattle in the infected herds for a series of years. There is some reason for the opinion that if the disease is prevented by vaccination the contagion will gradually die out. The objection has been raised by the dealers in vaccine that this Department should not injure their business by making and distributing vaccine free of charge. The reply to this objection is that the Department can not take measures for eradicating any diseases without interfering with the business of those who are dealing in remedies for such diseases; and that, nevertheless, these animal plagues can not be allowed to ravage the flocks and herds of the farmers indefinitely in order to keep up the market for vaccines and other remedies. The price charged for vaccine by commercial concerns has been thirty to fifty times the cost of manufacture, and at this exorbitant rate the majority of stockmen would not use it. The vaccine distributed by the Bureau has apparently been more freshly prepared and has given better results. It has rapidly interested cattle raisers in this method of prevention, and the demand for it is increasing. The State experiment stations should be encouraged to make and supply this material to the stockmen of their particular States.

(4) That a special effort be made to instruct representatives of the State experiment stations in the manufacture and use of the anti-toxin for hog cholera and swine plague. This, in connection with the formula published in Farmers' Bulletin No. 24, constitutes the best treatment for these diseases, and saves an average of 70 to 80 per cent of the hogs in infected herds. The Bureau has demonstrated the efficacy of the treatment, and it is now for the stations and commercial houses to supply the serum. The Bureau can not possibly undertake to supply this product, except perhaps in small quantities to experiment stations, since it has not the facilities for manufacturing it upon the scale that would be required to grant relief to the different sections of the country.

(5) That the Texas fever regulations be so amended as to prevent the movement of tick-infested cattle to the noninfected regions immediately above the quarantine line at any time of the year. The infected district is being extended in some directions by the gradual advance of the ticks which are carried by cattle crossing the line in the open season. There is little doubt but that many counties in Arizona, New Mexico, Texas, Oklahoma, Kansas, Missouri, and Tennessee which are now free from infection are liable to become infected by the unrestricted movement of tick-infested cattle. With the States

farther north this liability does not exist, and hence there must be a distinction drawn between cattle from the infected district which are to be fed immediately north of the quarantine line or in the more remote sections. This change in the regulations will require more inspectors, but it will be of great advantage, particularly to the Southern part of the country.

(6) That the experiments in dipping cattle with a view of destroying the ticks be continued. There has been no other practical plan suggested for the treatment of cattle from the infected district that would render them safe to mingle with susceptible stock. The dips heretofore used have not proved reliable and have been so irritating as to injure the cattle. The dipping has consequently been suspended pending the discovery of a more satisfactory mixture.

(7) That pure-bred cattle imported into the United States for dairy or breeding purposes be tested with tuberculin and that those which react upon this test be rejected. The cattle of European countries are much more extensively diseased with tuberculosis than are those of the United States, and the increase of the disease here is undoubtedly largely due to the importation of the contagion with animals brought across to improve our stock. The control of the disease has become a serious problem in many States, and a considerable number of such States are enforcing measures at great expense for its eradication. Under the circumstances the Department should certainly enforce the law for the exclusion of diseased cattle.

(8) The disinfection of hides to guard against the importation of the various forms of contagion which affect cattle, and particularly that of anthrax, has been one of the most serious problems about which the Bureau has been called upon to give advice. The law only prohibits the importation of the hides of neat cattle liable to be diseased, and provides for regulations to be made by the Secretary of the Treasury. The fact that the hides of other animals are as liable to bring disease as are those of cattle constitutes a defect in the law which at best prevents thoroughly efficacious measures. The attempt to disinfect hides from dangerous regions has shown that the satisfactory disinfection of hides without damaging them is a very difficult matter, and also that the measures of disinfection prescribed are for the most part either avoided entirely in foreign countries or are carried out in the most perfunctory and imperfect manner. Notwithstanding the numerous outbreaks of anthrax among people and animals which have occurred from such hides, it appears best to withdraw the requirement for disinfection abroad and to rely upon the total exclusion of cattle hides from countries where contagious diseases exist or to establish modern disinfecting plants at the principal ports of import.

(9) That the current provision of the annual appropriation act of this Bureau for developing and extending foreign markets for dairy

products of the United States be continued, and with such changes in amount and phraseology as may be necessary to enable thorough investigation at home and abroad of making, packing, and shipping butter and cheese for use in hot climates.

(10) That the recommendations already made from this Department for necessary legislation to extend the existing system of Government inspection and certification of meats and meat products for export, so as to include butter, cheese, and condensed milk and cream for export from the United States, be repeated and urgently pressed upon the attention of Congress. Reasons for such new legislation become more and more apparent. To those given in reports of previous years the following may be added: The work of this Department during several years, and involving the expenditure of much labor and money, to establish a reputation abroad for American dairy products will soon be destroyed without some such system of export inspection to safeguard reputation secured. Not long ago, through ordinary commercial agencies, this country practically supplied and controlled the cheese market of Great Britain. In some years we sent to England nearly 150,000,000 pounds, or two-thirds of our entire cheese product. Then, for the sole reason that no system of export inspection existed to guard the reputation gained, unscrupulous merchants, for mere temporary profit, exported great quantities of inferior and counterfeit cheese, until the reputation of States cheese was destroyed in England and that market lost to us. Canada, on the other hand, established a system of government control, was enabled to guarantee all cheese exported as pure and of standard quality, and thus gained and still holds the desirable British cheese trade which this country lost. As already explained, the recent work of this Department has materially aided in establishing a good reputation for States creamery butter in Great Britain. Our butter is in demand, especially in the northern counties supplied from Manchester, because of this reputation for fine quality. But this good work is already being undone. During the summer of 1899 an exceptional scarcity of European butter and consequent high prices in England have stimulated exports from New York. At the present writing it seems probable that this country will send to Great Britain this season several times as much butter as last year. During the month of August (1899) our butter exports were six times as great as for the same month a year ago. The receipts at Manchester, from this country and Canada combined, in some recent weeks have almost equaled those from Denmark. This new and profitable demand for good creamery butter had scarcely begun before large quantities of butter of inferior quality, also of "process," or renovated, butter, began to appear among the exports. The article last named, which is a more dangerous counterfeit than straight oleomargarine and butterine, has been sent to Liverpool via New York by the carload, put up in the style of package

adopted by this Department in its export trials to England, and labeled "Finest American creamery butter." The effect upon future butter trade with Great Britain will probably be like that which followed the export of so much filled cheese. This misfortune could have been prevented and renovated butter forced to enter British ports under its true color had the authority for export inspection been granted last year, as was recommended by the Secretary. This proposition has been indorsed by nearly all the large conventions of representative dairymen recently held in this country, and it has met with decided approval by commercial bodies and by individual exporters wherever it has been duly considered.

D. E. SALMON, *Chief.*

Hon. JAMES WILSON,
Secretary of Agriculture.

EXPERIMENTS WITH TEXAS FEVER AND SOUTHERN CATTLE TICKS.

GROWING NONINFECTED TICKS AND AFTERWARDS INFECTING THEM.

By E. C. SCHROEDER, M. D. V., and W. E. COTTON,
*Superintendent and Assistant Superintendent of Experiment Station of Bureau of
Animal Industry.*

The only means definitely known by which the disease recognized as Texas fever is in nature transmitted to susceptible, or Northern, cattle is the Southern cattle tick. With this fact in mind it was concluded that it would be necessary before advancing in our knowledge of the organisms which produce Texas fever to secure a stock of Southern cattle ticks free from the infection. It was evident that ticks of the desired kind could not be obtained by allowing them to grow on animals in the blood of which the infecting organism can live and multiply. Hence, an effort was made to grow the ticks on animals immune from Texas fever. Horses, mules, dogs, sheep, goats, rabbits, guinea pigs, and pigeons were used. Guinea pigs, rabbits, and pigeons were placed in cages containing beds of straw which literally swarmed with young ticks, and the other animals had large quantities of young ticks placed on their bodies and were kept for long periods of time in heavily infected tick fields. But the ticks persistently refused to take hold of and grow upon any of the animals named.

Experiment having thus shown that it was useless to attempt to grow Southern cattle ticks on other animals than cattle, it was determined to see what could be done by using very young calves, which are practically immune from Texas fever. How far we succeeded in obtaining noninfectious ticks and in reinfesting them later on, the following experiment will show without further introduction.¹

¹ Since making the attempt to grow the *Boophilus bovis*, or Southern cattle tick, on other animals than cattle, we have been repeatedly told by persons competent to judge that they occasionally grow on horses in the South. We have also learned from personal observation that the Southern cattle ticks will grow on donkeys. Early in the year 1898 a herd of donkeys from Texas was received at the experiment station near Washington, D. C. The donkeys were liberally sprinkled with ticks, which upon examination were found to be Southern cattle ticks, ranging in size from one-fourth grown to mature adults. Many of the ticks dropped off and produced eggs, which subsequently hatched. This occurred in a field in which was pastured a herd of Northern cattle susceptible to Texas fever. All the cattle became infested with ticks, and were kept under such close and careful observation that no consequent affection could have escaped us. No Texas fever resulted, showing that our view is correct, namely, that Southern cattle ticks grown on animals immune from Texas fever will lose the power to transmit the disease to Northern cattle.

At the experiment station in the fall of 1895 the observation was made that the Southern cattle ticks from a field used for tick experiments had spread to a neighboring field on somewhat lower ground. The fields were separated by two parallel lines of fence about 10 feet apart. The tick experiment field contained two North Carolina cows, recently received from the permanently infected Texas fever region, and a number of Northern cattle affected with acute Texas fever, to which they eventually succumbed.

In the field to which the ticks spread, a bull calf, No. 6, a young animal barely and prematurely weaned, was confined. This calf became well sprinkled with ticks, and was carefully watched to prevent any affection from which he might suffer from escaping detection. His temperature, general condition, and number and character of red blood corpuscles remained normal. Late in the fall a number of ticks which had matured on him were collected and placed in a bottle. In a few days eggs were produced and on December 20, 1895, they commenced to hatch. On December 26 he was confined in a heated stall and a lot of the newly hatched ticks was placed on various portions of his body. The ticks matured during the latter part of January, 1896. He suffered a slight loss in condition, a fact which was attributed to the close confinement in a small, artificially heated stall and to the drain on his system due to the blood consumed by a large number (from 3,000 to 4,000) of rapidly growing ticks. The only conditions observed which in any sense approximate the conditions indicative of Texas fever were a very slight reduction in the number of blood corpuscles and a very slight variation in their size.

Mature ticks were collected from No. 6 on January 24 and placed in bottles. Eggs were produced in a few days and began to hatch early in March.

On March 14, 1896, a cow, No. 33, and her calf, No. 34, were placed in a heated stall and well sprinkled with young ticks. The age of cow No. 33 was not less than 10 years; her calf, at the time it was used in the experiment, was about a week old. The cow was used to determine whether any infection remained in the ticks the parents of which had grown on No. 6, and the calf was used to further remove such infection in the case it existed.

A large number of mature ticks were collected from the cow and calf on April 7. Neither animal suffered an attack of Texas fever. A very slight reduction in the number of red blood corpuscles occurred in both about the time when the ticks were rapidly maturing—a time when Southern cattle ticks draw most heavily on their host. The temperature of the cow and calf remained normal, with the exception of a single elevation, lasting less than one-half day, to 104.3° F. in the cow.

Ticks hatched from eggs produced by the adults collected from cow No. 33, and subsequent generations of these ticks, were tested at all

seasons of the year on a dozen or more Northern cattle of various ages, from yearlings to very old cows, and were found to be constantly noninfectious.

In June, 1896, ticks hatched from eggs produced by adult ticks collected from cow No. 33 the previous April were placed on North Carolina cow No. 2. The object of this was to learn whether the ticks could be reinfected by living a generation on a cow in the blood of which the Texas fever organism is present. This cow was received at the experiment station the summer before from the permanently infected region. The ticks matured on her about the middle of July, and were collected and placed in bottles. Young ticks appeared August 22, and on August 26 they were placed on two Northern cows, Nos. 50 and 52. The young ticks, for an unknown reason, did not stay on the cows, and a second and more successful infection with ticks of the same lot was made September 1. As a result, cow No. 50, a young, vigorous animal about 2 years old, suffered a moderately severe attack of Texas fever, from which she made a good recovery. All the symptoms and conditions of the affection were present—high temperature, Texas fever parasites in the blood, a reduction in the number of red blood corpuscles from 6,332,000 to 3,225,000 per cubic millimeter of blood, and the usual changes in the character of the corpuscles.

Cow No. 52 was an old animal, in her ninth or tenth year. She also suffered an attack of Texas fever of much greater severity, the first symptoms of which were seen September 7. On the 11th the number of red blood corpuscles had fallen from the original 6,486,000 to 3,308,000 per cubic millimeter of blood, and Texas fever parasites of the large pear-shaped variety were present in large numbers. During the night of September 12–13 the cow died, and was examined post-mortem early the morning of the 13th.

Autopsy notes.—Body in fairly good condition; well sprinkled with ticks uniformly about one-eighth inch in diameter. Spleen enormously enlarged, softened, contents of a very dark-red, almost black, color; structure entirely broken down. Under the microscope preparations look like a solid mass of blood corpuscles. Liver with edges rounded, greatly enlarged, and stained a yellow color. Fresh sections on microscopic examination show extreme bile injection. Heart muscle pale. Extensive extravasations under the epicardium and endocardium. Kidneys congested. Urinary bladder distended with deep red-colored fluid, holding much solid matter in suspension. Blood generally very thin, and upon microscopic examination shows the presence of numerous large Texas fever parasites.

The noninfectious ticks were kept alive during the fall of 1896 and the following winter and spring by growing them generation after generation on Northern cattle which had never been exposed to Texas fever.

In the year 1897 a second experiment was made to confirm the tick reinfection experiment of the summer of 1896. Three cows, Nos. 1, 113, and 214, were selected for reinfesting noninfectious ticks. Cow

No. 1 was received from North Carolina during the summer of 1895; No. 113, from North Carolina late in the summer of 1889, and No. 214, from North Carolina early in the summer of 1892. After their arrival at the experiment station the three cows were carefully protected from exposure to Texas fever infection in any form, and it can be affirmed with almost absolute certainty that they carried no infection in their blood which had not persisted since the time of their removal from the South.

Noninfectious ticks were placed on the three North Carolina cows May 22, 1897, and on June 14 adult ticks appeared and were collected and put into bottles. The ticks from each animal were placed in separate bottles, carefully labeled, to make sure that no bottle should become contaminated with ticks from any other bottle.¹ Eggs were produced in a few days and began to hatch early in August.

On August 13, 1897, three Northern cows were sprinkled with the young ticks, the parents of which had matured on the North Carolina cows, as follows: Cow No. 58, ticks from cow No. 1; cow No. 59, ticks from cow No. 113; cow No. 56, ticks from cow No. 214. Special precautions were taken to prevent the infection of any one of the three cows with other ticks than those designedly placed on her, as such cross infection would have deprived the experiment of one of its most interesting features, in that it would have made it impossible to estimate the amount of virulence of the infection derived by the ticks from the particular Southern cow on which their parents matured.

Cows Nos. 56, 58, and 59 were received at the station early in the summer of 1896. Their age was about 10 years and their condition very good. They were as nearly alike in all respects as it was possible to obtain three cows. No. 56 was exposed throughout the summer and fall of 1896 to noninfectious ticks and raised several large crops of them on her body. No. 58 was used during the summer of 1896 to test a lot of presumably infectious ticks which was sent to the Bureau of Animal Industry from the South, but the ticks were too weak when placed on the cow to attach themselves. Cow No. 59 had previously not been used in any experiment.

The ninth day after the infection with reinfected ticks the first symptoms of Texas fever began to show themselves in cow No. 58. She suffered a very severe attack of the affection, from which she finally recovered after having been for days in what was regarded as a dying condition. She became greatly emaciated; her temperature

¹The method which we found from experience to be most practical for propagating Southern cattle ticks is to put the adult females into bottles which have a wide base, slanting sides, and a narrow neck, without the addition of soil, leaves, or anything else. The neck of the bottle is closed by means of a firm cotton plug, which permits a sufficient circulation of air, prevents too much evaporation and drying out, and effectually confines the young ticks, when they are hatched, within the bottle, from which no escape is possible for them until the cotton plug is withdrawn.

at one time was as high as 106.7° F. and remained a number of days, morning and evening, at or above 105°. Large Texas fever parasites were plentiful in her blood, and the number of red blood corpuscles, which was 6,400,000 per cubic millimeter of blood on the first day of the exposure to the ticks, fell as low as 2,085,000 per cubic millimeter.

Cow No. 56 did not show symptoms of Texas fever until a day or two after the first symptoms were observed in cow No. 58. But she suffered an even more severe attack of the disease, with a maximum temperature of 107.4° F. The destruction of red blood corpuscles was very rapid and parasites in the blood were numerous. Death occurred August 31, or eighteen days after the ticks were placed on her body.

Cow No. 59 was the last of the three to show symptoms of Texas fever and the first to die as a result of the affection. The disease in her case also was accompanied by a very high temperature, extreme and rapid destruction of red blood corpuscles, and the presence of numerous large blood parasites. She died August 28, fifteen days after exposure to reinfected ticks. The post-mortem examination of cows Nos. 56 and 59 showed the characteristic lesions of Texas fever—enlarged softened spleen, bile-injected and enlarged liver, congested kidneys, and blood-colored urine.

A synoptical review of the experiment is given below:

October, 1895.—Presumably infectious ticks from a field containing cattle recently received from the permanently infected Texas fever territory and sick Northern cattle which had become affected with what afterwards proved fatal Texas fever from being turned into the field, grown on bull calf No. 6. Result: No disease.

December, 1895.—Second generation of ticks grown on calf No. 6. Result: No disease.

March, 1896.—Third generation of ticks grown on cow No. 33 and on calf No. 34. Result: No disease.

March, 1896.—Fourth generation of ticks grown on North Carolina cow No. 2. Result: No disease.

March, 1896.—Fourth generation of ticks grown on several Northern cattle. Result: No disease.

August, 1896.—Fifth generation of ticks from adults grown on North Carolina cows placed on Northern cows Nos. 50 and 52. Result: Two cases of Texas fever, one of which ended in death.

August, 1896.—Fifth generation from adult ticks grown on Northern cattle placed on several Northern cattle, among which was cow No. 56. Result: No disease.

The sixth to the ninth generations, inclusive, from Northern cattle were grown on a number of different Northern cattle. Result: No disease.

May, 1897.—Tenth generation, from Northern cattle grown on North Carolina cows Nos. 1, 113, and 214. Result: No disease.

May, 1897.—Tenth generation grown on three Northern cattle. Result: No disease.

August, 1897.—Eleventh generation from ticks grown on Nos. 1, 113, and 214, placed on three Northern cows—Nos. 56, 58, and 59. Result: Three cases of Texas fever, two fatal.

August, 1897.—Eleventh generation from adults matured on Northern cows grown on several Northern cattle. Result: No disease.

The noninfectious ticks were kept alive a number of generations after the eleventh and finally died during the extremely cold weather in the winter of 1898-99.¹

The conclusions drawn from the experiment are as follows:

(1) That we succeeded in our efforts to obtain a stock of Southern cattle ticks which can be grown on susceptible cattle without producing Texas fever. This was done by growing ticks on a very young calf, young suckling calves evidently being wholly immune from Texas fever.

(2) That noninfectious cattle ticks which have lived successive generations on cattle that are susceptible to Texas fever without causing disease or other inconvenience than as a strictly external parasite became capable of producing fatally virulent Texas fever in susceptible Northern cattle after living only a single generation on a cow from the infected Texas fever territory.

(3) That the virulence of the infection which originally harmless Southern cattle ticks are capable of transmitting to Northern cattle after growing one generation on a Southern cow is apparently in no sense influenced by the length of time which has elapsed since the Southern cow was removed from the Texas fever region. And this is true even if the Southern cow has been shielded with the greatest care, after her removal to the North, from all the known conditions which are required to make a renewal of the infection in her system possible. Cow No. 1, at the time she was used in our experiment to reinfect noninfectious ticks, had been away from the infected territory and had been protected from exposure to Texas fever infection of every kind about one year. The same is true of cow No. 2 for two years, of cow No. 214 for five years, and of cow No. 113 for eight years.

(4) From the evidence which has been presented we see clearly that the *Boophilus bovis*, or Southern cattle tick, may be a relatively harmless external parasite. Southern cattle without ticks, pastured and stabled year after year at the experiment station with Northern cattle susceptible to Texas fever, have never in a single instance given rise to a case of Texas fever. Hence they, too, are in themselves harmless. But when Southern cattle and Southern cattle ticks come together, the result is expensive mischief in the locality where the event occurs for the owners of cattle susceptible to Texas fever.²

¹The term "Northern cattle" as used in this report is intended to signify cattle which are susceptible to Texas fever and which were born and raised north of the permanently infected territory.

²In addition to the infection of susceptible cattle with Texas fever by ticks and artificial blood injections, methods which have been repeatedly discussed in Bureau reports and other publications, infection may also take place probably as the result of fly bites. This means of infection, however, is rare, and requires that a susceptible animal should be brought in close proximity to another animal suffering with acute Texas fever. Two cases of the kind have occurred within my experience and are here presented. A Northern cow, No. 249, about two

Cow No. 56, used in the experiment, is especially interesting. She died of Texas fever eighteen days after an exposure to the offspring

years old and in fairly good condition, was confined for several weeks in a field containing a number of other Northern cattle. The field was separated 12 feet by a ditch and two lines of fence from a second field which contained several Northern cows affected with acute Texas fever. On August 28, 1893, No. 249 was examined as a precautionary measure before her intended use in a Texas fever experiment. Conditions were revealed by the examination which made it necessary to set her aside as unfit for the experiment. The cow was closely watched the remainder of the summer and fall, and her record, showing that she suffered an attack of Texas fever, is given below:

Record of cow No. 249.

Date of examination.	Number of red corpuscles per cubic millimeter of blood.	Texas fever parasites in the blood.
August 28, 1893	4,700,000	One-half of corpuscles infected.
September 6, 1893	4,797,000	Few present.
September 15, 1893	5,342,000	Do.
September 22, 1893	5,637,000	None.
October 20, 1893	5,700,000	No examination.
October 30, 1893	4,959,000	Small number.
November 2, 1893	3,987,000	Do.
November 8, 1893	2,890,000	Considerable number.
November 21, 1893	3,837,000	None.
November 29, 1893	4,461,000	Do.
December 21, 1893	6,000,000	Do.

The Texas fever parasites observed in the blood from August 28 to October 20 were of the small variety, which are visible only in stained preparations of blood. The parasites observed November 2 and 8 were of the large pear-shaped variety, visible in both fresh and stained preparations. The temperature of the cow varied from 101.7° to 105.6° F., and was highest during the first week in November, when the disease was in its most active stage.

The only exposure to which cow No. 249 was subjected was that which has been specified. No ticks developed on her or on any of the other cattle in the same field with her. The other cattle, which were equally exposed, did not become affected with Texas fever or any other disease.

The second case of Texas fever of this kind occurred two years later and was like the first, with the following exceptions: In the first the disease was transmitted from cattle in a neighboring field; in the second, from a cow in the same field. In the first case the cattle from which the infecting material was derived suffered in consequence of exposure to Southern cattle ticks, and in the second the cow from which the infection was derived suffered as the result of a hypodermic injection of blood from a Southern cow. And in the first case—a young animal—the affection was followed by recovery; in the second—and old animal—by death.

The record of the second case follows: Cow No. 5, about ten years old and in fair condition, was confined in a small field with three other aged Northern cattle and three calves. One of the three additional cows—No. 9—received, on July 19, 1895, a hypodermic injection of 10 cubic centimeters of blood drawn from the jugular vein of Southern cow No. 113. The Southern cow had been away from the infected territory and protected from exposure to infection for six years, and was confined in a field on another portion of the experiment station. Cow No. 9 suffered, as a result of the injection, a very severe attack of Texas fever, which ended in death

of ticks grown one generation on a cow which had not been exposed to infection for a period of five years. The very ticks which produced the fatal affection were descendants of ticks which had grown generation after generation during the previous year on cow No. 56 without producing Texas fever or other disease, or the least degree of immunity from Texas fever.

Whether the existence in nature of the Texas fever organism is limited to the (as yet) only partly known forms in which it is present in cattle and ticks remains an open question, which will probably find no solution until something has been added to our knowledge of the life history of the disease-producing parasite so economically important. It is certainly very desirable that thorough investigations should be made to determine whether there are sources from which either cattle or ticks can draw an original infection; that is to say, sources from which cattle can become infected without the intervention of ticks, or from which originally noninfectious ticks can obtain

July 30. At least 50 to 75 per cent of her blood corpuscles contained large pear-shaped, paired Texas fever parasites. A fly caught on the cow's body shortly after her death was found to have its abdomen distended with blood. This blood was pressed out on a slide and examined under the microscope and was seen to contain many almost perfect red corpuscles, nearly every one of which was infected with a large Texas fever parasite.

On August 10, 1895, eleven days after cow No. 9 died, cow No. 5 was reported by one of the station employees to be passing bloody urine. She had been acting like a sick animal for several days, and was immediately examined and found to be affected with Texas fever, already well advanced.

Record of cow No. 5.

Date of examination.	Number of red corpuscles per cubic millimeter of blood.	Texas fever parasites in the blood.
August 10, 1895	1,577,000	Large form present.
August 12, 1895	2,439,000	None.
August 13, 1895	2,914,000	Do.
August 16, 1895	2,833,000	Large form present.
August 19, 1895	3,120,000	Do.
August 22, 1895	3,520,000	Do.

On August 29 cow No. 5 died. She had become extremely emaciated. The autopsy showed the usual lesions of Texas fever. No ticks were present on her body and no ticks appeared on the cattle which were kept during the balance of the summer and fall in the field in which she became affected and died. The two remaining Northern cattle and the three calves which were exposed to the same conditions were repeatedly examined throughout the summer and fall, but did not show a single symptom of Texas fever.

From these two cases of Texas fever it is reasonable to conclude that flies, and possibly other blood-sucking insects and external parasites, can carry Texas fever infection from one animal to another. But it must be admitted, when the conditions are examined under which the two cases we have before us occurred, that Texas fever produced through the medium of fly bites, etc., must be very rare, and that no general outbreak of the affection can be produced in this manner.—E. C. S.

the organism which causes Texas fever in cattle without first growing a generation on an animal which carries the infection in its system. Successful investigations along this line are important because they may throw greater light upon the immunizing question in its relation to Texas fever, and because they bear the promise to brighten the prospects, which are as yet very dim, of the final and entire removal of Texas fever from the United States.

A NOTE ON THE VITALITY OF THE SOUTHERN CATTLE TICK.

By E. C. SCHROEDER, M. D. V.,

Superintendent Experiment Station of Bureau of Animal Industry.

On February 3, 1897, a number of mature female cattle ticks (*Boophilus bovis*) were taken from a cow on which they had grown at the Experiment Station of the Bureau of Animal Industry. The ticks were placed in cotton-stoppered flasks and kept in a warm room. Eggs were produced in a day or two, and by March 11 they had practically all hatched. The young ticks, without other food than could be derived from the empty eggshells and dried bodies of the dead adults, and without other water or moisture than could be absorbed from the atmosphere, remained in the flasks until July 21, when they were taken out and placed on a cow. Some of the young ticks, or, more truly, small old ticks, were dead, but the majority were alive and possessed sufficient strength to attach themselves to the cow and to grow into full-sized adults of the ordinary kind by August 13, on which day a number of mature females were collected. The female ticks produced eggs which subsequently hatched.

The young ticks which hatched on or before March 11 remained in seemingly stationary condition until July 21, a period of one hundred and thirty-two days, and then, upon being placed on a cow, developed into vigorous, fertile adults in twenty-three days. This shows a degree of resistance to drying and starvation which is surprising, and gives some idea of the difficulties which would have to be met and overcome before any section of the South could be effectually cleared of ticks.

The time which elapsed from the day on which the adult ticks were collected (February 3) until the day on which a host was provided for the young ticks (July 21) is one hundred and sixty-eight days, or very nearly the half of one year. How much longer this period of time could be under different conditions where ample moisture is present can only be surmised. The ticks which died in the flasks had the appearance as though death was due to drying.

The time which elapses before mature female ticks produce eggs, after dropping from the cattle on which they have grown, varies from a single day to several weeks, and the required time for the eggs to hatch

varies from one to three months. This is from actual observation. A low temperature retards both the laying and the hatching of eggs. If these figures are considered, the conclusion that the *Boophilus bovis* may persist for the better part of a year without a host does not seem unreasonable.

In the above experiment noninfectious ticks were used. Had they been infectious an experiment would have been made to determine whether the infectious character was retained. It does not follow that the organism of Texas fever in the unknown form in which it is associated with newly hatched ticks possesses an amount of vital resistance to adverse conditions equal to that shown by the young ticks.

From some observations of the last two or three years, about which it is hoped something more specific can be said in the future after more thorough investigations have been made, it seems that the first crop of ticks in the spring in the South is noninfectious. If this is found to be strictly true, it will show that the tick can outlive the infection of Texas fever, and yearly does so, and is yearly reinfected in the manner in which the noninfectious ticks in one of the experiments at the station were reinfected. It will also indicate, if any original source of Texas fever still exists in the South, that its whereabouts will have to be located and its character studied rather from the side of the cattle than the ticks. But these are purely conjectures, without well-defined value, and are allowed to stand only because they may suggest a new side from which the life history of the Texas fever organism can be approached. At this date, after years of study, the life history of the Texas fever organism is still surrounded by so much mystery that it can not be said with any degree of assurance whether cattle ticks are simple carriers or agents of transmission of the infection, or whether they actually play an important part in the life of the organism.

A NOTE ON THE PERSISTENCE OF THE TEXAS FEVER ORGANISM IN THE BLOOD OF CATTLE.

By E. C. SCHROEDER, M. D. V.,

Superintendent Experiment Station of Bureau of Animal Industry.

On October 4, 1895, two calves, natives of Maryland, from four to five months old, and in fairly good condition (Nos. 14 and 26), received each a hypodermic injection of blood drawn from the jugular vein of a Southern cow. For calf No. 14 Southern cow No. 2 was used, and for calf No. 26 Southern cow No. 113. Cow No. 2 was received from North Carolina the previous summer, and cow No. 113 from the same State during the summer of 1889.

The two calves suffered an attack of Texas fever so mild in character that it would have escaped notice without careful examination of the blood.

In August of the following year the blood of Nos. 14 and 26 was tested as to its infectious character on two Northern cows. The record of the test is given below:

August 5, 1896.—Cow No. 45, in good condition, from 5 to 6 years old, native of Maryland, received a hypodermic injection consisting of 25 cubic centimeters of blood drawn from the jugular vein of heifer No. 14. The result was a severe attack of Texas fever, accompanied by a high temperature, parasites in the blood, and extreme destruction of red blood corpuscles. The number of red corpuscles fell from 6,000,000 per cubic millimeter of blood on August 7 to 1,500,000 per cubic millimeter on September 2, and reached its lowest mark at 1,600,000 per cubic millimeter September 8, and then gradually returned to normal. The cow made a slow but good recovery.

August 5, 1896.—Cow No. 46, in the same condition, of about the same age and from the same source as cow No. 45, received a hypodermic injection of 10 cubic centimeters of blood drawn from the jugular vein of heifer No. 26. The result was an attack of Texas fever even more severe than No. 45 suffered, which ended in death on August 19, or fourteen days after the injection. All the symptoms of Texas fever were present—high temperature, parasites in the blood, destruction of red blood corpuscles, and blood-colored urine. The original number of blood corpuscles was 5,977,000 per cubic millimeter of blood; the day before death the number had fallen to 2,441,000 per cubic millimeter. The post-mortem examination showed the usual lesions of Texas fever.

This experiment shows clearly that the infectious blood of Southern cattle when injected into young, susceptible cattle in the fall of the year, although it may cause only a very mild attack of Texas fever, makes the blood of the young cattle sufficiently infectious to cause fatal Texas fever in adult cattle ten months afterwards. It also illustrates to a certain extent the difference in the severity of Texas fever when it affects old and young cattle, although some allowance must be made for the fact that the young cattle were infected in October and the old cattle in August.

AN EXPERIMENT IN BLOOD AND SERUM INJECTIONS IN CONNECTION WITH TEXAS FEVER INVESTIGATIONS.

By E. C. SCHROEDER, M. D. V.,

Superintendent Experiment Station of Bureau of Animal Industry.

In a previous experiment it was shown that young cattle became practically immune from Texas fever after suffering a fairly mild attack of the disease late in fall or during winter produced by the injection of infectious blood from a Southern cow; and in a note on two young animals (Nos. 14 and 26) which were immunized by the process above referred to and then protected from infection, it was shown that ten months after receiving the immunizing injection of infectious blood the organism of Texas fever was still present in their blood, and possessed sufficient virulence to cause fatal disease upon reaching the blood of susceptible adult cattle. From these facts, and the permanently infectious character of the blood of Southern cattle,

which has been repeatedly demonstrated, it is apparent that the organism of Texas fever is in some manner retarded in its growth in the blood of immune cattle, either by the production of an antitoxin of insufficient strength to destroy it entirely or some alteration in the system of the cattle about which nothing is known; that is to say, the cause which prevents the multiplication of the organism is a modification of its environment and not of its own character, otherwise it would fail to display the power of rapid multiplication, which is seen whenever it reaches the blood of a new host not previously infected.

If an antitoxin is produced, we may reasonably assume that the injection of large quantities of blood or blood serum from immune cattle into susceptible cattle is equivalent to transferring a portion of the immunity of the former to the latter. Hence an experiment was made to gain some information of the relative severity of disease produced by the injection of large and small quantities of blood and large quantities of blood serum from a Southern immune cow into a number of Northern susceptible cattle. It was not supposed that a total immunity from Texas fever could be obtained from blood and serum injections. The best result hoped for was that the severity of a subsequent attack of Texas fever would be reduced in a fairly well-marked degree. Nothing more was to be expected from an antitoxin which allows the infecting organism against which it acts to persist indefinitely in the blood of immune animals.

On January 6, 1898, blood was drawn from the jugular vein of cow No. 1. (This cow was removed from the permanently infected region of North Carolina in the summer of 1895.) A portion of the blood was used immediately to inject cows Nos. 62, 93, and 95, and the remainder set aside for serum to separate out. On January 8 cow No. 94 was injected with a portion of the serum. She received a second and a third injection of the serum January 10 and 12. On January 14 cow No. 79 was also injected with serum of the same kind used for No. 94. The cows, with the exception of No. 79, were old animals in fairly good condition. No. 79 was a young cow in fairly good condition, and at the time of the injection in apparently perfect health. All the injections were made subcutaneously. A record of the cattle follows:

Record of cow No. 62.

January 6, 1898.—Injected with 10 cubic centimeters of blood from cow No. 1. Suffered a severe attack of Texas fever; became exceedingly emaciated, but finally made a good recovery.

January 7.—Number of red corpuscles per cubic millimeter of blood, 6,753,000.

January 14.—Number of red corpuscles per cubic millimeter of blood, 6,057,000.

January 19.—Number of red corpuscles per cubic millimeter of blood, 5,466,000.

January 22.—Number of red corpuscles per cubic millimeter of blood, 4,165,000.

February 17.—Number of red corpuscles per cubic millimeter of blood, 1,413,000.

Large Texas fever parasites were present in the blood January 17, 18, and 19.

Record of cow No. 95.

January 6, 1898.—Injected with 10 cubic centimeters of blood from cow No. 1. Suffered an attack of Texas fever, which ended in death January 22. Post-mortem examination showed the usual lesions of the affection. Microscopic examination of the blood and organs revealed the presence of numerous large single and paired pear-shaped parasites. The destruction of red blood corpuscles before death was not very great. On January 21, the day before death, Texas fever parasites of the large variety were very numerous in the blood.

January 7.—Number of red corpuscles per cubic millimeter of blood, 7,954,000.

January 14.—Number of red corpuscles per cubic millimeter of blood, 5,804,000.

January 17.—Number of red corpuscles per cubic millimeter of blood, 6,083,000.

January 21.—Number of red corpuscles per cubic millimeter of blood, 5,433,000.

Record of cow No. 93.

January 6, 1898.—Injected with 100 cubic centimeters of blood from cow No. 1. Suffered an attack of Texas fever; lost considerable in condition, and made a good recovery.

January 7.—Number of red corpuscles per cubic millimeter of blood, 5,780,000.

January 13.—Number of red corpuscles per cubic millimeter of blood, 6,020,000.

January 17.—Number of red corpuscles per cubic millimeter of blood, 5,431,000.

January 21.—Number of red corpuscles per cubic millimeter of blood, 3,836,000.

January 24.—Number of red corpuscles per cubic millimeter of blood, 4,950,000.

January 28.—Number of red corpuscles per cubic millimeter of blood, 5,211,000.

February 17.—Number of red corpuscles per cubic millimeter of blood, 3,481,000.

Large Texas fever parasites were present in the blood on January 14, 17, 21, and 24; they were especially numerous on the 17th.

Record of cow No. 94.

January 8, 1898.—Received an injection of 100 cubic centimeters of serum from blood of cow No. 1.

January 10, 1898.—Received an injection of 100 cubic centimeters of serum from blood of cow No. 1.

January 12, 1898.—Received an injection of 100 cubic centimeters of serum from blood of cow No. 1.

Suffered an attack of Texas fever, lost considerable in condition, and made a good recovery.

January 7.—Number of red corpuscles per cubic millimeter of blood, 7,247,000.

January 15.—Number of red corpuscles per cubic millimeter of blood, 5,786,000.

January 21.—Number of red corpuscles per cubic millimeter of blood, 6,333,000.

January 24.—Number of red corpuscles per cubic millimeter of blood, 6,326,000.

January 28.—Number of red corpuscles per cubic millimeter of blood, 3,777,000.

February 2.—Number of red corpuscles per cubic millimeter of blood, 5,003,000.

February 17.—Number of red corpuscles per cubic millimeter of blood, 5,411,000.

Large Texas fever parasites were numerous in the blood on January 26.

Record of cow No. 79.

January 14, 1898.—Received an injection of 100 cubic centimeters of serum from cow No. 1. Died before she could become affected with Texas fever, and not as the result of the injection. The post-mortem examination showed that death was

due to inflammation of the bowels. No lesions of Texas fever were found, and consequently this cow is given no further consideration in connection with the experiment. Had she remained alive and, together with No. 94, escaped an attack of Texas fever, the two would have been exposed later on to virulent disease to determine the amount of immunity gained from the serum injection.

The following table shows, approximately, the severity of the affection suffered by cows Nos. 62, 93, 94, and 95:

No. of cow.	Amount and kind of material injected.	Number of red corpuscles per cubic millimeter of blood.		Physical condition as a result of the affection suffered.
		Normal.	Lowest.	
62	10 c. c. blood	6,753,000	1,413,000	Extreme emaciation.
95	.....do.....	7,954,000	5,433,000	Died in 16 days.
93	100 c. c. blood	5,780,000	3,481,000	Quite thin.
94	300 c. c. serum.....	7,247,000	3,777,000	Do.

The experiments indicate that large doses of infectious blood or serum will produce milder disease than small doses and that the severity of the disease produced by large amounts of blood is no greater than that produced by large amounts of serum. The small number of animals used does not warrant drawing conclusions, however, and a recognition of this fact led to the following experiment in the summer of 1899:

Eight cattle about the same age (from 8 to 10 years) and in about the same condition, all presumably equally susceptible to Texas fever, were selected and given injections of blood drawn from the jugular vein of a Southern immune cow. The amounts of blood injected varied from 10 cubic centimeters to 400 cubic centimeters, and part of the injections were made subcutaneous and part intravenous. The Southern cow which supplied the blood was the same which was used in the former experiment. She was selected because among the Southern cattle at the experiment station she was the most recent arrival from the permanently infected Texas fever region. As a result of the injections the eight cows suffered attacks of Texas fever, accompanied by high temperature, parasites in the blood, destruction of red blood corpuscles, and loss in physical condition. Only one cow died. The low death rate is attributed to the cool rainy weather which prevailed at the time the cattle were suffering the severest stage of the disease. The observations made are condensed in the following table. All the injections were made on August 1, 1899.

No. of cow.	Amount of blood injected.	Method of injection.	Number of red corpuscles per cubic millimeter of blood.		Texas fever parasites in blood.	Remarks.
			Normal.	Lowest.		
129	10	Subcutaneous	5,841,000	2,104,000	Numerous, Aug. 11.	Lost greatly in condition.
161	10	Intravenous...	5,896,000	2,011,000	Numerous, Aug. 8.	Do.
156	50	Subcutaneous	6,076,000	3,052,000	Small number, Aug. 8, 10, 11.	Do.
158	50	Intravenous...	4,917,000	1,919,000	Small number, Aug. 8, 15.	Recovery at one time doubtful.
163	100	Subcutaneous	5,326,000	2,887,000	Small number, Aug. 10, 11.	Died September 23. ¹
154	100	Intravenous...	5,222,000	3,126,000	Numerous, Aug. 10, 11, 15.	Lost greatly in condition.
155	400	Subcutaneous	5,133,000	2,106,000	Very numerous, Aug. 10, 11.	Do.
160	400	Intravenous...	6,050,000	2,640,000	Numerous, Aug. 11, 15.	Do.

¹ Post-mortem examination showed the usual lesions of Texas fever.

After suffering one attack of Texas fever, beginning about August 10, the cattle seemingly recovered, and then suffered a second attack about the middle of September. It was during the second attack that No. 163 died. At the present time (October 18, 1899) practically no difference in the condition of the seven cows which survived is apparent. They are very thin, but improving constantly. A temperature record of the cattle is given at the end of this article.

If we now review the results obtained, we see that the quantity of blood from an immune cow, always infectious, which is injected into a susceptible cow has no bearing on the consequent affection, provided it is sufficient to cause an attack of Texas fever. Neither does it make a difference whether the blood is injected under the skin or directly into the circulation. Hence nothing is to be gained by using large quantities of blood for immunizing purposes. The antitoxin which may be present can not be introduced in sufficiently large quantities in blood to act in a perceptible degree as a protecting agent.

Whether investigations in the field of serum treatment for the cure and prevention of Texas fever can lead to practically good results is a question, for the further discussion of which the facts at hand are too meager. But it is well to bear in mind in this connection that an antitoxin which is too weak to wholly destroy the infectious material in the blood of an animal which possesses the highest degree of

immunity does not encourage the expectation that it may ever take the rank of an economically useful substance.

If we accept the conclusion, which can reasonably be drawn from all the blood injections made in this experiment, that the injection of a large quantity of infectious blood causes disease of no greater severity than the injection of a small quantity, we shall see that more danger exists, when blood injections are used for immunizing purposes, that the dose may be too small rather than too large. A dose of 10 cubic centimeters as an immunizing injection seems sufficient. At the Experiment Station no failure to produce Texas fever has followed the injection of this amount. Smaller doses may be satisfactory, but are not recommended, as no immunity is gained without an attack of Texas fever. With a 10 cubic centimeter dose we may feel quite certain that an attack of the affection has occurred, even if it was too mild to be diagnosed by the ordinary methods within the reach of general practice. With a smaller dose an element of uncertainty remains.

The number of Texas fever parasites in the blood of immune cattle is very low. After the microscopic examination of several thousand stained cover-glass preparations, only two or three were found in each of which a single parasite could be detected. A cow which received an injection of one-half cubic centimeter of infectious blood at the Experiment Station several years ago escaped the affection, while another cow which received 10 cubic centimeters of blood from the same source twenty days later suffered a severe attack of Texas fever.

It may be well in this place to again assert that cattle which are to be exposed to Texas fever in the permanently infected territory, if an attempt is made to immunize them by means of blood injections, should be injected before they are too old, as with advancing age the susceptibility to Texas fever increases and in an equal measure the danger that the affection may prove fatal. It should also be remembered that the evils attendant upon Texas fever are least when the weather is cool.

Temperature record of cattle.

1898.	No. 62.		No. 63.		No. 64.		No. 65.		No. 66.		No. 67.		No. 68.		No. 69.		No. 70.	
	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
Jan. 7	102	100.7	100.6	101.6	101.3	100.6	101.3	100.6	101.3	100.6	101.3	100.6	101.3	100.6	101.3	100.6	101.3	100.6
8	101.4	101	101.5	101.3	101.4	101.3	101.3	101.8	101.4	101.3	101.8	101.3	101.4	101.3	101.8	101.3	101.4	101.3
9	101.8	102.2	101.9	101.5	104	104	104	101.3	100.6	101.3	100.6	101.3	100.6	101.3	100.6	101.3	100.6	101.3
10	102	100.5	101.9	103	103.4	103.8	101	101.4	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3
11	101.7	101.2	102.8	102	103	102.8	101.1	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3
12	102.3	100.6	101.8	102.8	103.9	104.1	101.8	100	100	100	100	100	100	100	100	100	100	100
13	102.3	102.1	102.7	104.1	104.2	104.3	102.3	101.6	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3
14	102.7	103.2	103.5	105	103.6	102.7	101.3	99.8	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
15	104.6	105.1	105.9	105	103.4	103.3	102.5	102.9	100.7	100.7	100.7	100.7	100.7	100.7	100.7	100.7	100.7	100.7
16	106	102	103.7	103.2	102.8	101.8	105	103	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3
17	105.7	105.7	103	102.7	102.6	102.8	103.8	103.2	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
18	106	103.1	103.7	104.4	103.5	104.7	104.3	104.8	101	101	101	101	101	101	101	101	101	101
19	104.7	103.4	105.8	106	103.4	104	104.8	104.3	100.7	100.7	100.7	100.7	100.7	100.7	100.7	100.7	100.7	100.7
20	105.5	104.7	106.2	106.4	102.4	102.1	105.8	104.1	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
21	104.6	103.3	106.4	105.4	104	103.1	101	101.8	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
22	104.4	102.8	105.8	105.4	104.3	103.7	Dead.	101.8	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
23	102.8	100.6	104.2	102.3	105	103.8	103.2	104.1	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
24	101.4	101.2	102	102	105.2	103.2	103.2	104.1	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
25	101.6	99.4	102	102.3	105.6	103.7	103.7	104.1	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
26	101.3	101.3	103	101.4	103	101.5	101.5	104.1	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
27	101.3	100.6	101	101.4	103	104.8	104.8	104.8	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
28	100.5	102.1	103	100.5	105.6	104.2	104.2	104.2	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
29	101.2	99.5	101.7	100.2	103	101.6	101.6	101.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6

NOTE.—The temperature of the cattle after February 21 remained normal.

Temperature chart of Texas fever cattle.

1890.	No. 154.		No. 155.		No. 156.		No. 157.		No. 158.		No. 159.		No. 160.		No. 161.		No. 162.	
	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
Aug. 2.	132.4	104	104	104	133.2	133.2	132	133.4	133.2	133.2	132.4	133.2	133	133.4	133.5	133	133.5	133
3.	133	133.4	104.4	103	132.4	133	133	133.4	133	132.4	133	132.6	133	133.6	132.4	133	132.4	133.2
4.	131.8	133.4	102	104.6	132.2	133.4	132.0	133.4	131.4	133.2	133.2	131.4	133.2	133.6	131.2	133.2	131.0	133
5.	132	133.4	102	102.8	132.8	132.8	132.4	133	131.6	133	132.2	131.6	133	132	132.2	132.4	132.4	132.8
6.	132	133	103	103	132	132	133	133	132	132	134.2	134.2	134.4	135.4	135	133	132	133
7.	133.6	135.8	101	107	133	133	133	136.4	136.4	136.2	132.4	132.4	132	133.8	131	135	131.2	133
8.	135	107	103	135.6	132	134.4	133	136.4	136.4	136.2	132.6	132.6	131	135.8	132.4	136.6	131.6	136.4
9.	134	133	133.2	136.2	133	135.2	134.4	136.8	136.8	136.6	135.2	135.2	136	133.2	133.2	135.6	131.6	136.4
10.	133	135.4	104.4	106	133.6	133.6	134	136	135.8	135.8	135	135	133.8	135.2	131	135	131.4	135.4
11.	133.4	104	106	135	133	133.4	133.8	134.6	134.6	135.4	135	135	133	134	133	133.6	133.4	134
12.	132.4	105.4	104	105	134.4	135.4	134.2	135.8	134.6	134.6	136	136	133	134	132.6	135	135	135.8
13.	134.2	104.4	132.5	134.6	133.6	133.6	134.2	135.5	134.2	134.2	135	135	134	133.5	134.2	135.5	134.2	135.6
14.	133.8	133.0	133.4	133.6	133.4	135.4	133	133.4	133.4	132.4	134.4	134.4	133	134	133.6	135	134.6	137
15.	131.4	102.4	102	132.2	133.6	134.2	131.8	133	133	134	132.4	134.4	133.4	133.6	134	134.2	135.2	135.4
16.	132.6	104.8	102.2	135.4	133.4	135.4	133	133.4	133.4	133.4	134.4	134.4	133	134	133.6	134	135.4	137.6
17.	130	102	103.4	104	133.4	134.4	133.6	133.4	133.4	133.4	134.4	134.4	133	134	133.6	134	135	136.4
18.	131.4	103.6	101.4	105	132.4	135	131.4	133	134.2	134.2	134.2	134.2	133	134	133.4	132	135.4	133
19.	131.2	101.4	101.6	133.6	132	134.2	133	134.2	134.2	134.2	134.2	134.2	133	134	133.4	132.4	135.4	135.4
20.	131	102	101	133	131	134	132	134	134	134	134	134	132	134	133	133	134	136
21.	132	104.6	101	134.2	132.6	133	131	134	134	134	134	134	131	132.6	133.8	133	132.2	135.4
22.	130.4	102.6	102	135	132.4	134.2	131.6	135.6	135.6	134.4	134.4	134.4	131	132	131.2	133.4	131.4	135
23.	131.6	102	130.6	104	131	133	131	134	134	132.2	134	132.2	134	132	131	132.5	131	133
24.	132.2	104	101.6	134.2	131	133.6	131.6	135	135	131.2	134	131.2	134	131.4	131.4	132.6	131	134.4
25.	132	103	132	135	134.2	135	131	135	135	131	133	133	132.4	132	133	131.4	131	134
26.	131.4	102.6	101.4	133.4	131	133	131.6	133	133	131	132.4	132.4	130.6	132.2	131.2	132.6	131	133
27.	132.6	101	102.4	131.1	133.6	133.8	132.4	131.8	133.4	133.4	131	132.4	131	132.2	131.9	131	132.8	130.4
28.	131	103	130.6	133	130.8	134.4	131	133.6	133.6	131	134.4	134.4	131	132	130.4	132	132	133
29.	130	134	133.2	136	130	134	130	133.4	133.4	132.4	134.4	134.4	131	132	130.8	133.4	130.2	134
30.	130.2	131	131	133	131.6	132.4	130	133	133	131	134	134	130.4	133	131	132	131.2	132.8
31.	130.4	130.4	131	133	130.4	130.4	130	133	133	131.4	131.4	131.4	130.4	130.4	131	132	131.6	134

[illegible]

Temperature chart of Texas fever cattle—Continued.

1899.	No. 154.		No. 155.		No. 156.		No. 158.		No. 159.		No. 160.		No. 161.		No. 163.	
	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
Oct. 6.	99.6	102.3	99.3	102.2	97.5	100.8	97.8	104.7	97.1	102	99.6	102.6	98.8	102.4	.....	.....
7.	101.1	103	101.7	104.4	100.3	102.8	102.4	105	99.6	102	101.1	102.4	101.3	101.6	.....	.....
8.	100.2	102.4	101.2	102	100.4	102.2	100.6	101.2	100	100.6	101	102	100	101.6	.....	.....
9.	100	103.1	101.4	104.5	100.3	102.7	101.6	104.8	100.1	102.8	100.4	102.2	100.8	102.8	.....	.....
10.	100.7	102.8	102.6	104	100.6	102.8	101.6	104.7	100.4	102.6	100.8	102.8	100.8	102.5	.....	.....
11.	100.6	102.4	102.5	103.8	101	102.7	100.8	103.4	100.3	101.8	101	102	100.7	101.6	.....	.....
12.	101	103.4	102.4	104.8	101	103.8	101.4	104.2	100.8	102.8	101	103.2	100.4	102.4	.....	.....
13.	101.9	102.5	103.5	103.4	101	101.8	101.6	104	100.4	102.7	100.8	103.2	101	102	.....	.....
14.	101.8	102.4	101.2	101.7	101.2	102	101	104	100.4	102.3	101	102.4	101	101	.....	.....
15.	102.4	102	101.8	101.6	101.6	102	101	105	101.3	101.2	101	102	101	102.2	.....	.....
16.	100.6	102.6	100.6	101.7	100.6	101.6	100.3	101	100.4	100.6	100.8	101.3	100.3	101	.....	.....

SOME EXAMPLES OF THE DEVELOPMENT OF KNOWLEDGE CONCERNING ANIMAL DISEASES.¹

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INTRODUCTION.

The acquirement of knowledge in the domain of animal diseases during the century now closing has been constant and amazing, and compares favorably with the advancement in other branches of science which, with the zeal and activity of investigators, has attracted the wonder and admiration of the world. While something is known even to the general reader of the progress of knowledge in this field, and of the usefulness of this knowledge in explaining and preventing the diseases of man, there are comparatively few who have an adequate conception of the vast array of facts which have been accumulated and the revolution which these facts have brought in the prevailing ideas as to the nature of the various diseases and the methods by which they should be treated. To enter into all the details of the development of this subject during the century would require the writing of a series of volumes on the respective subdivisions, which, when completed, would be of professional rather than popular interest. A review of this character is manifestly impossible, even if such detail were desirable, in this volume. The writer, therefore, deems it wise to confine himself to the work that has been done upon a few great problems which are, or should be, of interest to the many, and the elucidation of which has done most to ameliorate the condition of mankind as well as that of the domesticated animals.

The beginning of the nineteenth century almost defines the line at which the old and fantastic doctrines on animal pathology began to crumble and to be replaced by facts and scientific principles. Previous to that time a more or less elaborate system had been compiled, based upon observations made during the past history of the world; but as the ideas in regard to the structure and activities of the animal body were in many cases crude and erroneous, it is not surprising that the conceptions of disease were often distorted and strange, as viewed from the standpoint of our present knowledge. What is it that has brought light out of the darkness and order out of the chaos of the

¹ This article also appears in the Yearbook of the Department of Agriculture for 1899.

preceding centuries? What new factor, what change of method, was introduced with this century which accounts for the overthrow of the old doctrines that had been built up from the world's previous experience, and the substitution for these doctrines of definite and accurate knowledge? The answer to these questions is as interesting as the story of the achievements, and is of particular value at the present time. It should be a guide to us in directing the forces that will in all human probability make the twentieth century even more glorious in its accomplishments than the one which preceded it. The purpose of this paper is, therefore, not only to show the great strides of progress, but to indicate how this progress has been made.

INEFFECTIVENESS OF OBSERVATION WITHOUT EXPERIMENTATION.

It was in the early part of the seventeenth century that Bacon pointed out the weakness of the old speculative philosophy which built a great superstructure of doctrine or theory upon a foundation having a minimum of substantial fact and evidence. Such structures were without stability; they represented the individual workings of the philosopher's mind rather than the truths of nature, and for that reason they were constantly toppling over, to be replaced by another philosophic effort no more substantial than the first. Although Bacon at that time clearly demonstrated the necessity of first gathering all available facts and of interpreting these without preconceived bias by the inductive method, it was long before these teachings had their legitimate influence, either in human or veterinary medicine, and they are by no means universally accepted, outside of the scientific world, even at the present day.

The great question has always been, How are the facts relating to any branch of natural science to be obtained? The philosophers of the old school said, "by observation and deduction;" and they have their followers to-day who seek to direct, through legislative enactment, that physiological and pathological investigations shall be limited to "observation." But, if there is one great truth which stands out more prominently than others in the history of the progress of science, it is that observation, as contrasted with experimentation, is of itself insufficient to solve the problems or lead to an accurate comprehension of the facts.

EFFORTS TO DISCOVER THE CIRCULATION OF THE BLOOD BY OBSERVATION.

The insufficiency of observation without experimentation is demonstrated by the long-continued efforts to discover and explain the action and use of the heart, the arteries, the veins, and the blood. For hundreds of years the anxious students of physiology had made observations upon the living and the dead subject, but the mystery, ever elusive, had baffled the keenest vision. Thus, Hippocrates

(460 B. C.) knew something of the movement of the blood. Aristotle (384 B. C.) taught that in man and the higher animals the blood was elaborated from the food in the liver, thence carried to the heart, and sent by this organ through the veins over the body. Praxagoras of Cos (341 B. C.) distinguished the arteries from the veins and regarded the former as air vessels. Erasistratus (304 B. C.) and Herophilus, of the Alexandrian school, taught that, while the veins carried blood from the heart to the organs of the body, the arteries carried a subtle kind of air or spirit. Galen (130 A. D.) discovered that the arteries were not merely air pipes, but contained blood. Servetus (1553) added to this knowledge the belief that the blood flowed from the heart to the lungs and from the lungs back to the heart. Thus, the studies and observations of two thousand years had given only a very incomplete and inaccurate idea of the circulation, leaving the great central fact of the heart's influence unknown and unsuspected.

HARVEY'S EXPERIMENTS FOR THE DISCOVERY OF THE MOVEMENTS OF THE HEART AND BLOOD.

It remained for Harvey (1578-1657), the great contemporary of Bacon, to elucidate the subject most thoroughly by a long series of experiments upon living animals. He tells us that he began his investigations into the movements of the heart and blood by experimenting and seeing the phenomena in living animals. He minutely described what he saw in pigs, dogs, serpents, frogs, and fishes. He even made use of slugs, oysters, lobsters, and insects, and lastly of the chick while still in the shell. He particularly described his observations and experiments on the ventricles, the auricles, the arteries, and the veins. He explained the mechanism of the valves in the veins, showing that their function was not to moderate the flow of blood from the heart, as Fabricius believed, but to favor its return to the heart. He clearly demonstrated the effect of obstruction of the blood stream in arteries and veins by the forceps in the case of a snake and by a ligature on the arm of a man. He proved that it is the contraction, not the dilation, of the heart that coincides with the pulse; that the pulse is not produced by the arteries expanding and filling themselves, but by the blood being forced into them and causing their enlargement; that there are no pores in the septum of the heart, and that all of the blood in the right ventricle is sent to the lungs and returned by the pulmonary veins to the left side of the heart, being forced again by the left ventricle into the arteries, round by the smaller veins into the *venæ cavæ*, through which it is brought back to the right side of the heart, making a complete circulation; that the blood in the arteries and that in the veins is the same blood; that the action of the right and left sides of the heart, auricles, ventricles, and valves, is the same, the mechanism in both being for the reception and propulsion of liquid and not of air; that there is no to-and-fro undulation in the veins, but

a constant stream; that the dynamical starting point of the blood is the heart and not the liver. (Pye-Smith.)

All of these conclusions were revolutionary in their effect upon the doctrines of the times, and thus Harvey, by a few years of experimentation, completed the solution of this great problem, and contributed more in the way of definite facts to sustain his views and to clearly explain the phenomena of the circulation than had been furnished by all his predecessors from Hippocrates to his own time.

COMMENCEMENT OF SYSTEMATIC STUDY IN VETERINARY SCIENCE.

It was not until after the middle of the eighteenth century that veterinary schools were established and systematic instruction in animal pathology was commenced. Previous to that time there had been published some remarkable treatises on the diseases of animals, but the building up of the science may be said to have had its beginning at the foundation of the schools dedicated to the investigation and teaching of veterinary medicine. The first veterinary school was established at Lyons, France, in 1761; the second at Alfort, near Paris, in 1765. These were followed by one at Copenhagen, in 1773; Vienna, in 1775; Berlin, in 1790; and London, in 1791.

The beginning of the nineteenth century, therefore, found veterinary instruction in progress in the principal countries of Europe, and considerable literature suitable for text-books was already accessible. The study of the subject was stimulated not only by the establishment of the schools, but by the invasion of deadly epizootics, which had followed the course of the armies to all parts of the Continent and which threatened the annihilation of the domesticated animals. Knowledge of these plagues and the best means of controlling them had become essential to the existence of animal husbandry and the maintenance of the food supply. The accumulation of facts and correct views concerning these diseases was the greatest task of the veterinary profession, and the progress of this work is perhaps the best general indication that can be accepted in regard to the development of animal pathology.

GLANDERS AND FARCY.

One of the most terrible plagues of equine animals is called glanders when it affects the air passages and lungs, and farcy when it appears upon the skin. The principal symptoms are a discharge from the nose, ulceration of the inside of the nasal passages, particularly of the septum, enlargement of the glands under the jaw, and pustules of the skin. This disease, from which there is seldom recovery, was known to the Greek and Latin writers as one of the most serious diseases of horses and asses, and its contagiousness was quite generally admitted.

EARLY VIEWS REGARDING GLANDERS.

About 1749 the elder Lafosse, of Paris, began to teach the spontaneous origin of glanders, and endeavored to show from theoretical considerations and clinical observation that this was a purely local disease of an inflammatory nature and could not be contagious. At first this view was combated by many practitioners and by the veterinary schools, but being in harmony with certain medical doctrines it gained adherents, was taken up by the Alfort school, at first timidly and later with all the energy and eloquence of Renault, Delafond, and H. Bouley, and became predominant in France and perhaps also in Germany.

Renault thought that the disease might originate as a consequence of the absorption of pus from suppurating surfaces or abscesses, and this view was largely accepted. H. Bouley substituted the hypothesis that its origin was due to the exhaustion of the vital forces as a result of bad hygienic conditions or excessive work. Those who specified instances where the disease spread from an affected horse to others were met by the citation of instances where it did not spread. As H. Bouley afterwards admitted, the advocates of the hypothesis of noncontagion and spontaneous generation, by a singular disposition of mind, believed themselves authorized to invoke against the facts which proved contagion other facts where contagion did not result. This was the consequence of wrong methods of investigation and of improper use of evidence. Positive evidence establishes a fact: negative evidence can not overthrow positive evidence. It was by not understanding this apparently axiomatic proposition that the erroneous views in regard to the causation of glanders were so widely accepted and did so much harm.

The veterinarians of France, especially those of the army, were largely from the Alfort school, and, acting upon the teachings which they had received, they no longer treated glanders as a contagious disease, but permitted the retention of diseased animals and allowed these to be stabled with healthy ones without precautions to guard against communication. The inevitable happened, and the continental countries were overrun with glanders. The cavalry horses in particular were decimated, and thousands that became useless for the army were sold to civilians and served to propagate the contagion upon the farms, the very fountain head of the equine supply. From 1830 to 1840 the condition was almost intolerable, and the disease was becoming more and more prevalent. Those observers who believed the disease due to contagion were everywhere met by others equally sincere and able who believed it of spontaneous origin. It is a striking example of the difficulties of settling such questions by clinical observation alone.

EXPERIMENTS REGARDING THE CONTAGIOUSNESS OF GLANDERS.

In November, 1836, the French war department undertook to have the question of the contagiousness of glanders settled by experimental investigation. A commission was appointed, the members of which were mostly partisans of the doctrine of noncontagion, and evidently strongly biased, for after more than three years' investigation, in which 138 healthy horses were used, they were still unable to reach a decision. The minister of war then added to the commission a number of eminent men, members of the Academy of Sciences, who came with unprejudiced minds and a scientific spirit to the study of this important problem.

In 1837 an incident had occurred which had served to check to a certain extent the enthusiasm of those who denied the contagiousness of the disease. In this year Rayer recognized that a man who came under his observation was affected with a disease resembling glanders. Such cases, it appears, were not uncommon, but had been designated as putrid, or adynamic, fever. Investigation developed two facts of importance: First, the subject was a stable man, and as such had been intimately associated with horses; secondly, some of the horses which had been under his care were ascertained to be affected with glanders. This was strongly corroborative of Rayer's diagnosis, but it was not sufficient to meet the arguments of those who thought otherwise. Might not the occupation of the man and the presence of glandered horses be simply coincidences and without bearing upon the origin of the disease? It was necessary to prove the identity of the disease in the man with the well-known glanders of the horse. How was this to be done? Obviously not by disputation or by clinical observation, for these methods were incapable of reaching a definite and incontestable decision. There was but one course that had in it the promise of success, and that was experimentation. If the disease with which the groom was affected could be inoculated upon a horse, and if this horse developed the characteristic symptoms of glanders, then this would constitute a demonstration that the man was suffering from the equine disease. Fortunately for science and for humanity, this test was made. The liquids from the diseased regions of the man proved extremely virulent when inoculated upon the horse, and the disease which developed was glanders with all its well-known characteristics.

Rayer, who had investigated this case of glanders in man, was added to the commission of inquiry, as was also the well-known Boussingault. The strongest partisans of noncontagion were Renault and Magendie, both members of the commission. October 8, 1841, ten horses, carefully selected and perfectly healthy, were stabled with eleven other horses which presented the symptoms of chronic glanders. Each of the healthy animals was placed between two diseased ones, in order

to intensify the contagion to which they were exposed, in case such contagion existed. Only eleven days had passed when four of the healthy horses presented symptoms which indicated that they had been infected. On November 22 there were only two horses remaining which did not show symptoms of infection. December 4 glanders with all its characteristics had developed in one of the horses, and by February 11 three more horses were in the same condition. As a result of about four months' close association nine out of ten healthy horses showed symptoms of glanders, and with four of these the disease was so fully developed as to be entirely characteristic.

The commission caused two of these horses to be killed, and on post-mortem examination found all the lesions of chronic glanders. The mucous membrane of the trachea and bronchi was covered with ulcerations, among which were found cicatrices, which Renault believed justified him in suspecting that the animals had been affected before the beginning of the experiment. However slight may have been the grounds for doubt, after the first experiment, it was decided that another test should be made. This was commenced April 11, 1842, with seven selected horses, which were placed two by two in the stables, so that each healthy horse would come in contact only upon one side with a glandered horse. By August 7 glanders had developed in every one of these experimental animals.

Just previous to these last-mentioned investigations, that is, in 1840, a special commission composed of officers of the different branches of the cavalry service, which had been charged to submit a plan of a model stable in which should be united the most advantageous hygienic conditions, made a report attributing the development of glanders among cavalry horses to the unsanitary conditions of the stables. An academic commission reported by the younger Bouley held the same opinion and thought that the bad construction of the cavalry quarters, the unhealthfulness of the stables, the crowding of the animals, and the vitiation of the atmosphere should be placed among the principal causes of what was called spontaneous glanders. Contagion, the true cause of the disease, was left out of consideration or given an entirely subordinate position, while attention was concentrated upon conditions which, at most, could but favor, to a certain extent, the propagation of the infection. Does not this bring to mind the contentions now being made by those who wish to find the cause of tuberculosis in some other agency than contagion and who invoke the influence of the identical conditions which the French military commission of 1840 found sufficient to explain the origin of glanders? H. Bouley, one of the most able contestants of the theory of contagion, and who afterwards frankly admitted his error, says in regard to the project for eradicating the disease by reconstructing the stables:

If the certainty had been acquired, as it has been to-day, that contagion alone was the cause, and that to guard against it was sufficient to avoid the ruinous

losses which glanders then occasioned, there is no doubt that the reconstructions proposed would not have been undertaken, or, at least, that they would have been upon a smaller scale and the expenses distributed over a larger number of years.

CONTAGIOUSNESS OF GLANDERS DETERMINED AND EFFORTS TO CONTROL THE DISEASE.

One other question remained to be solved. It was held by some that acute glanders might be contagious, while the chronic form, that usually encountered in the horse, could not be communicated. In the experiments which have been already mentioned the persons who, held to this opinion thought that the contagion was explained by the disease having assumed an acute form in some of the animals to which exposure had been made. To answer this contention Saint-Cyr made a series of inoculation experiments, reported in 1863, from which he concluded:

Under all its forms, in all its degrees, in all its conditions, in all its stages, and, finally, at every instant of its existence, glanders is contagious; and there is always danger of contagion, not possible, eventual, or conditional danger, but certain, actual, and always menacing danger.

This ended, in France, the contest over the contagiousness of glanders. A similar difference of opinion had existed in other countries, especially in Germany, but the problem was solved for all by experimental exposures to the contagion or by inoculation. Without these experiments upon living animals it is impossible to conceive how the views of those who interpreted differently the facts of observation could have been harmonized; and in the presence of doubt on the essential question of contagion or spontaneous origin, there was and always would have been hesitation and lack of thoroughness in applying preventive measures and in enforcing regulations for eradicating the disease.

After settling the question of contagion there were still two great problems which confronted the veterinarian in his efforts to control this disease. The first of these related to the cause of the disease; and while there was ignorance in regard to this it was impossible to have an intelligent comprehension of the conditions under which the contagion survived or of the kind and strength of disinfectants required for its destruction. This problem was solved simultaneously during the year 1882 by Bouchard, Capitan, and Charrin, in France, and by Loeffler and Schuetz, in Germany. Here, again, inoculation experiments were absolutely necessary to demonstrate that the suspected bacillus was the cause of the disease. Numerous forms of bacteria are usually obtained by making cultures from virulent material, and there is no way of learning which variety produces the disease except by making the trial, that is, by inoculating susceptible animals with a pure culture of each of these micro-organisms. In that manner the bacillus of glanders, now known as the *Bacillus mallei*, was proved to be the active agent of the conta-

gion, and the acquisition of this fact has brought with it a flood of light that has served to clear up the doubt and confusion of earlier years.

The second great problem was to find a speedy and certain method of diagnosing the disease. Glanders with horses is usually a chronic malady, which in its first stages presents very slight and indefinite symptoms that are entirely insufficient to enable the observer to state positively that the animal is affected with this dangerous and fatal disease. Nevertheless, the disease is contagious at that period and is liable to be disseminated to other horses and to the attendants; indeed, it is the animals that have failed to develop characteristic symptoms which are most dangerous, since very often they are not even suspected as sources of contagion. Sometimes affected horses live for several years in this condition, and attention is only attracted to them finally because a series of horses which have been exposed to them have successively developed the disease. Even after such horses were suspected it was a most difficult and embarrassing matter for the veterinarian to produce sufficient evidence to warrant their destruction, particularly if they happened to be valuable or if the owners were attached to them. This difficulty of diagnosis was largely responsible for the continuance of the contagion, and it was especially felt in large stables containing many horses and where it was consequently essential to successful treatment to have every affected animal removed.

The first efforts to aid clinical observation in making a diagnosis were by inoculation. Either the suspected horse was inoculated with its own nasal discharge (auto-inoculation) or another individual of the equine species was used for this purpose. Very often satisfactory evidence of glanders could be obtained in this way, but in far too many cases the results were uncertain or unreliable. With the bacteriological studies and the inoculation of small animals came the knowledge that the guinea pig was very sensitive to this contagion, and that, if inoculated in a proper manner, it would present characteristic symptoms in a few days. This was an extremely valuable discovery, and where only one or at most a small number of horses were suspected, it made it possible for the veterinarian to reach a quick and reliable decision.

JUSTIFIABLENESS OF INOCULATIONS IN GLANDERS.

The question is now raised as to whether these inoculations are justifiable, and the antivivisection societies, with many of the humane societies, have joined in an effort to secure legislation to make it a criminal offense to conduct such experiments upon living animals. The ethical questions relating to the alleged wrong of causing suffering to an innocent guinea pig, either for the advancement of science or the diagnosis of a disease, are too broad to receive more than a mere

mention in this connection. It may be admitted, however, that so long as we acknowledge the right and the morality of raising animals to be slaughtered for food, and so long as we permit such a painful operation as castration to be performed on millions upon millions of individuals to make them more docile, to cause them to fatten more readily, to improve the quality of the meat—in a word, for the financial profit which arises from the operation—it is inconsistent to deny the propriety of a method of experimentation which in the aggregate has saved much more distress than it has caused and which is essential to the advancement of medical knowledge. In the case which has just been mentioned, for instance, it may be asked whether the practitioner would be justified in leaving a horse suspected of glanders to come in contact with other animals, perhaps to communicate the disease to some human being, when he could definitely decide the question by inoculating two or three guinea pigs. It might be said that a suspected horse should be put in quarantine in order to prevent such untoward consequences, but there are all degrees of suspicion, and a horse can not be quarantined under the law and his owner put to expense and loss without some evidence. It is a question of danger and suffering with men and horses on the one side and with guinea pigs on the other. Under such circumstances the objections appear unworthy of serious consideration.

THE MALLEIN TEST FOR GLANDERS.

Fortunately, a continuation of the experiments with living animals has led to a discovery which largely does away with the necessity of inoculating guinea pigs or other creatures in order to make a diagnosis in the doubtful cases to which reference has been made. In cultivating the bacillus of glanders it was observed that it produced during its growth a toxic substance which, when injected into the tissues of an animal affected with glanders, caused a local swelling and raised the body temperature to such a marked extent as to be of great assistance in making a diagnosis. This toxin is called mallein, and the experiment of injecting it for the purpose of making a diagnosis is called the mallein test. It is particularly useful in cases where a large number of horses which are stabled together have been exposed, and where it is, consequently, of the utmost importance that those which have become infected shall be recognized and removed at the earliest moment. It may not be quite as accurate a test as the inoculation of guinea pigs, but it is more expeditious, less expensive, and saves the guinea pig from dying of glanders, though it may eventually die of some other disease equally painful, even if it does not contract it by inoculation.

In addition to the investigations to which reference has been made, there have been many others yielding much information in regard to

the pathological anatomy, histology, and pathology of glanders which for want of space can not receive consideration.

VARIOLA (COWPOX, HORSEPOX).

Some time during the sixth century there was introduced into Europe one of the most horrible and fatal diseases from which mankind has ever suffered. This disease, now known as variola, or smallpox, is no longer greatly feared, but at that time and through the middle ages, and in fact down to the beginning of the nineteenth century, it was a scourge that could neither be avoided nor conquered. Practically every adult person's face showed the scars. One-tenth of the deaths were caused by it. In England in 1796 the death rate reached the highest point, being $18\frac{1}{2}$ in every 100 deaths from all causes. No city or district was long free from it. People exposed themselves to it or were inoculated with the contagion in order to have an attack under as favorable circumstances as possible, and thus secure immunity for the future. Inoculation was of some benefit—often produced a comparatively mild form of the disease and gave immunity; it had the great disadvantages, however, that it frequently caused a fatal attack, and, in all forms, it kept up and spread the contagion.

JENNER'S DISCOVERY OF A PREVENTIVE OF SMALLPOX.

In 1798 Edward Jenner announced his discovery that smallpox might be prevented by inoculation with the virus of cowpox, and that cowpox was identical with a disease of horses known by the farriers as grease, or sore heels. This discovery has been of such enormous advantage to humanity, and there have been so many questions raised relative to the nature of the so-called grease of horses, from which cowpox originates, that it is of unusual interest to inquire how Jenner's discovery was made and what developments in our knowledge of the disease have since occurred.

There is no doubt that there was a popular belief in Jenner's native county of Gloucestershire, England, to the effect that the men and women who milked the cows and who developed the vesicular eruption of "the cow disease," would not afterwards contract smallpox. To what extent this belief was held in that section of England, and whether it existed in other countries, are subjects in regard to which there is little reliable information. It is certain that those physicians of the period who had heard of the belief regarded it as due to an erroneous interpretation of facts, but Jenner's conclusions were accepted so promptly that we are justified in concluding that the skepticism and opposition were not greater than might reasonably be expected toward a similar discovery at the present day.

As an indication of the wonderful change which has been brought about since the introduction of vaccination, the writer has taken the latest mortality statistics compiled by the Marine-Hospital Service,

based upon the returns from 1,597 cities and towns in the United States, for the year ended December 31, 1897. The population covered was 22,472,334, the total number of deaths 338,994, the number of deaths from smallpox 44, being in the proportion of 1 to 7,704.

How did Jenner make this discovery? How did he determine that the belief of certain people of his county in the protective power of the cowpox eruption against the dreaded smallpox was more worthy of credence than the opinion of others that it did not have this effect? He accomplished this in the only possible way—by experimentation. A boy was vaccinated from a pustule upon the hand of a milkmaid which had been contracted in milking affected cows. The vaccination produced the pustule so well known at the present day, as the result of this operation. After recovery from the vaccination the boy was inoculated with smallpox virus, an operation then very common in England. From this inoculation there were only the effects usually seen following the inoculation of persons who had recovered from an attack of smallpox.

Jenner went a step further and inoculated another child with virus taken from a pustule upon the teat of a cow in an outbreak of the so-called spontaneous cowpox. This child also developed a pustule at the point of inoculation, with slight general symptoms of illness. Starting from this child many arm-to-arm inoculations were made, proving the characteristic appearance of the disease and that it could be propagated indefinitely.

Jenner also cited the case of a farrier who, in caring for horses affected with a disease called grease, had contracted an eruption of the hands with ulceration and suppuration that was accompanied with quite severe illness. Six years later Jenner inoculated this man at different times upon the arms with smallpox virus and only succeeded in producing slight inflammation, which soon disappeared. An identical observation was made with a farmer who had contracted an eruption by taking care of a horse having this disease of the pasterns called grease. It was also observed that when the horses having this eruption were cared for by the same men who milked the cows the disease was carried by these men and caused the eruption of cowpox.

ORIGIN OF COWPOX.

The belief of Jenner that cowpox originates from the inflammation of the skin of the horse's pastern, properly known as grease, has been generally accepted, and we still find the statement in medical works that grease, or equinia mitis, is the origin of cowpox. Now, what is this grease which is communicable to the cow, and from the cow to man, granting such remarkable immunity from smallpox? The disease known to the veterinarian as grease is a more or less aggravated inflammation of the skin of the heels and adjacent parts of the horse, with cracks and fissures, from which there is an offensive discharge,

which looks greasy, but which is really a serous exudation. This inflammation may increase until the whole surface is ulcerated and covered by fleshy excrescences slightly resembling grapes in form, and in this stage was popularly called "the grapes." This disease arises from irritation due to moisture, mud, and filth in contact with the skin of the lower part of the limbs. It is not contagious; inoculation from it produces nothing resembling the vaccine vesicle, and for many years it was a mystery how Jenner could have found in this local and spontaneous disease the origin of cowpox.

In 1802 Dr. Loy, of England, published an "Account of some experiments on the origin of cowpox," in which he stated that the horses which communicate the eruption to the men who groom them have at the commencement of the disease symptoms of fever and marked indisposition, which subsides after the appearance of an eruption upon the heels and upon the skin of the greater part of the body. Loy, desiring to confirm the experiments of Jenner, did not hesitate to inoculate his own brother, with the result that after a few days inflammatory symptoms appeared, followed on the eighth day by a vesicle, with slight symptoms of fever, which continued for a day or two. This eruption had precisely the characters of the true vaccine.

In another experiment Loy inoculated the udder of a cow with clear lymph taken from the heel of an affected horse, which produced a characteristic vaccine vesicle. The limpid fluid from the vesicle on the cow's udder was used to vaccinate a child, and produced a vesicle which completely protected from an inoculation with smallpox virus made on the ninth day. Loy also inoculated directly from the vesicle on the horse to the arm of a child, and successfully produced the vaccine vesicle. From this child three other children were successfully inoculated, and their immunity was afterwards tested by inoculation with smallpox virus. With none of them did the smallpox inoculation produce more than a very slight inflammation, which disappeared by the fifth day.

This extremely valuable work of Loy appears to have been lost sight of for many years, and veterinarians and physicians sought in vain in the various local affections of horses' feet for the virus of cowpox. Chapped heels, grease, and even fistulas furnished material for unsuccessful inoculations, and some of the ablest men of the first half of the century absolutely denied that cowpox could originate in this manner. This opinion was due to the failure of Jenner to describe the disease of horses from which the virus was obtained, and to the ignorance of the farriers, which led them to confound widely different diseases under the one name of "grease." Loy's description, in which he clearly points out the general symptoms preceding the eruption with the horse, and the appearance of vesicles on various parts of the surface of the body, should have been an

indication of the cause of failure, but did not attract attention at the time.

The great veterinarians of England, including Coleman and Percival, denied the existence of a disease of horses which could be communicated to cows and produce cowpox, and it was not until sixty years after the observations and experiments of Jenner and Loy that the mystery was cleared up and the facts demonstrated.

The rediscovery of the variola of the horse was largely accidental. In the spring of 1860 a number of horses near Toulouse, France, were affected with a disease which seemed to be of an epizootic character; in less than three weeks it appeared in more than a hundred animals. According to Sarrans, the veterinarian in charge, this disease began with a slight fever, soon followed by swelling of the hocks, with heat and tenderness of the skin, and the appearance of many little pustules on the surface of the swollen parts. In three to five days a purulent discharge began, which lasted eight or ten days, during which the inflammatory symptoms gradually disappeared. After this second stage the pustules gradually became dry, and from the fifteenth day the crusts and matted hair began to fall, leaving scars of variable development. The pustules did not appear on the limbs only, but also upon different parts of the body, particularly about the nose, lips, thighs, and vulva.

Sarrans did not recognize in this disease the "grease" of Jenner, but he did observe its contagious character. No cows were affected, because the persons taking care of the horses did not engage in milking, and there was no opportunity for transferring the contagion. It is, therefore, probable that the nature of the malady would not have been discovered had not one of the affected horses been taken to Professor Lafosse, of the Toulouse veterinary school. At the first visit only febrile symptoms could be made out, but eight days later the animal was suffering from lameness, with swelling of the left posterior pastern, which was hot, painful, and covered with pustules, discharging an ammoniacal liquid less fetid than the exudation of grease.

It occurred to Lafosse that this was the acute form of grease, and probably the disease to which Jenner had traced the origin of cowpox. He therefore inoculated the udder of a cow with this equine discharge, which he believed was the product of the initial period of grease (*eaux-aux-jambes*). The success of this inoculation was complete, and in eight days a pustule appeared at each point where the virus had been inserted. These elevations were large, flat, firm, and circular, with a central depression. There could be no mistake; these pustules were the cowpox of Jenner, drawn from their equine source, and they confirmed the accuracy of the conclusions of that eminent investigator.

In order that the demonstration might be complete, a second cow

was inoculated from the pustules of the first, causing a typical cowpox eruption, which was in turn inoculated successfully upon a child and a horse. A second child was inoculated with virus taken from this horse and developed a typical vaccine vesicle. Finally, comparative inoculations were made with virus of equine origin and with the ordinary vaccine, which demonstrated that the former produced larger and better developed vesicles, but which were slower in their evolution than the latter.

HORSEPOX.

There was here satisfactory experimental demonstration that this horse disease was identical with cowpox, but what was the horse disease? Lafosse at first considered it the early stage of the acute form of grease, but as it developed he observed the confluent pustules developing upon the pasterns and fetlocks, and afterwards disseminated over other parts of the body, particularly upon the lips and nose. This differentiated the affection from grease and proved it to be a specific eruptive disease. It was now plain why there had been failure for so many years to obtain the cowpox vesicle by inoculating with the discharge from greasy heels and fistulas of the feet. Two entirely different and distinct diseases had been confounded under the same name.

These unexpected results obtained at Toulouse led H. Bouley, of the Alfort veterinary school, to undertake, in 1863, the inoculation upon the cow of all eruptive diseases of the horse which by chance came under his observation in his daily clinics. Strangely enough, the very first disease that he inoculated produced a clearly defined case of cowpox. What was this disease of the horse? It could not be designated "sore heels," since it was localized in the head, and consisted of small blisters, the size of a pea, upon the mucous membrane of the lips, the lower surface of the tongue, the inner face of the cheeks, and the gums. There was no trace of the eruption except within the mouth.

During the next few months this horse disease, which was capable of generating cowpox, appeared in the clinics of Alfort under all the various forms which it is capable of assuming. At one time localized in the pasterns, as seen by Jenner, at other times affecting the hocks, the general surface of the body, the nose, or the internal surface of the mouth; it at first appeared inexplicable that all of these different manifestations of disease should produce cowpox when inoculated upon the udders of bovine animals. "If I was able to recognize the specific nature of the disease," says Bouley, "it was owing to the course that I had adopted of interrogating by inoculation all the eruptive diseases of the horse that the chances of the clinic brought under my eyes."

When all the evidence from these and other inoculation experiments

was brought together, it became plain that what had been regarded as a number of distinct diseases was in reality but one and the same contagion affecting different parts of the horse's body. When this contagion was transferred from animal to animal by the shoer in handling the lower part of the limbs, the eruption was usually confined to the pasterns and fetlocks. When the communication was by means of the currycomb and brush, the pustules were disseminated over the surface of the body, but appeared particularly where the skin was thinnest and the virus most easily introduced, as upon the neck, thighs, and hocks. When the animal contracted the disease by smelling of affected individuals or rubbing its nose against them, the eruption very naturally occurred upon the skin of the lips and nose and upon the mucous membrane of the interior of the nostrils. When the virus was taken into the mouth with contaminated forage, the vesicles appeared upon the mucous membrane of the lips, tongue, and cheeks. And, finally, when the contagion was communicated by the act of copulation, the eruption was seen upon the external organs of generation. To this specific disease, which appeared under so many forms, H. Bouley gave the appropriate name of horsepox.

RELATION OF SMALLPOX, COWPOX, AND HORSEPOX.

Whether the virus of this disease is taken from the horse or cow and inoculated upon a susceptible human being, it produces substantially the same effects—a characteristic vesicle with regular course of development, which confers immunity, more or less complete, from smallpox. This remarkable result has raised the question as to the relation which exists between smallpox, on the one hand, and horsepox and cowpox, on the other. Are these essentially one and the same disease due to contagion of the same origin, but which has been modified by developing in different animal species for a series of generations? or, are they distinct, different, and incapable of being changed one into the other? There have been many investigations made with a view of settling this question, which have been variously interpreted, but for most pathologists it is probably still held as undecided. The experiments upon animals as well as upon mankind prove that cowpox grants immunity from smallpox and smallpox from cowpox; and it is, therefore, reasonable to conclude that they are closely related, if not identical, in origin. It has, however, been shown to be very difficult, if not impossible, to transform smallpox into cowpox by inoculating the virus upon a series of bovine animals, and in the few cases where it is supposed that this was accomplished there are reasons for doubting the correctness of the conclusion.

EXPERIMENTAL INOCULATIONS UPON ANIMALS AND CHILDREN.

What strikes the student of methods as most conclusive in the history of the development of our knowledge of variola is the prominence

of experimental inoculations upon animals and children. The clinical observer had problems presented to him which he was unable to solve by observation alone, and in order to clear up the mysteries and obtain light he was obliged to combine experimentation with observation. There are those, no doubt, who will be horrified by the references to these experiments upon children, but it should be remembered that at that period smallpox was the great destroyer of children; that they were frequently and purposely exposed to it or inoculated with its virus in order that they might have an attack at a favorable time and obtain immunity. Smallpox inoculation, if not as common as the vaccination of the present day, was certainly very largely practiced. Under such circumstances, the inoculation of children with smallpox virus, after they had been vaccinated with cowpox, is no more to be condemned than the general practice of inoculation, which before the discovery of vaccination was so widely adopted and so useful as a prophylactic measure.

CONTAGIOUS PLEURO-PNEUMONIA OF CATTLE.

SPREAD OF PLEURO-PNEUMONIA.

In the early part of the eighteenth century there began to appear accounts of an acute lung disease of cattle, which affected these animals in the mountains of Suabia and Switzerland. This disease very slowly extended to adjacent parts of Germany, Italy, and France, and in 1769 the first really important investigation was made of it in France by Bourgelat, the founder of the veterinary schools, who published an excellent account of his observations. Bourgelat described what he saw—the symptoms, the appearance of the diseased organs, the course of the disease, and its fatal character. He considered that the cause was atmospheric variations, cold and abundant rains, to which the animals were exposed, and sudden passage from warm stables to such rains. There is no evidence that he suspected contagion.

During the wars of Napoleon the disease was considerably spread over Continental Europe, but it was not until the increased traffic and interchange of animals, which dates from about 1820, that its general dissemination occurred. From 1820 to 1840 it extended into most parts of France and Germany. In 1826 Belgium was infected; in 1833 it reached Holland; in 1839 it was carried from Holland to Ireland; in 1841 or 1842 it reached England, and from there was exported to Sweden in 1847. The contagion was brought to the United States with imported cattle in 1843. It was carried to Spain in 1846, to Denmark in 1848, to South Africa in 1854, and to Australia in 1858.

During all of these years there was a constant discussion and contest between the clinical observers as to whether the disease was of spontaneous origin or whether it was due to contagion. Haller, in 1773, expounded the doctrine of contagion with a clearness and force

that is surprising, and stated that even in Switzerland, the home of pleuro-pneumonia, this disease does not arise except by contagion. In 1792 Chabert published his "Instruction sur la peripneumonie," in which his great influence was thrown with those who believed in contagion. Nevertheless, from 1800 to 1850 the conclusion that pleuro-pneumonia was not a contagious disease steadily gained adherents. During this long polemic and period of uncertainty, sanitary regulations were neglected, the plague spread to all parts of Europe, and even invaded America. Before the experimental proofs of contagion were generally accepted the disease had been carried to the African and Australian continents, and practically the whole cattle-producing world was infected.

This brief history of the invasion of a large part of the world by one of the most serious and fatal forms of contagion demonstrates again the impossibility of determining such pathological problems by mere observation, and yet we are told by those who oppose experimentation upon living animals that the investigator must not experiment, but must confine himself to clinical observation. Let us see how the question as to the contagiousness of bovine pleuro-pneumonia was finally solved.

INVESTIGATIONS OF PLEURO-PNEUMONIA IN EUROPE.

In 1850 the prevalence of the disease had become so serious that Dumas, then minister of agriculture, commerce, and public works of France, appointed a commission to investigate its nature and cause. This commission at once proceeded to test the contagiousness of pleuro-pneumonia by experimentation. To determine the question as to whether the disease could be communicated from a sick to a well animal, they adopted the plan of introducing sick animals into a stable of healthy ones and noting what followed. The result of this experiment was that 50 per cent of the exposed animals contracted pleuro-pneumonia; 15 per cent died and 35 per cent recovered. In addition, 30 per cent of the exposed animals contracted a cough indicative of a very mild form of the disease, while 20 per cent appeared to entirely resist the influence of the contagion. It is this 20 per cent, remarked H. Bouley, which furnished the facts upon which rest the arguments of the noncontagionists.

In Great Britain there was a similar difference of opinion on the subject of contagion, and as late as 1859 an article was published in the Transactions of the Highland Agricultural Society of Scotland, written by Professor Dick, principal of the Edinburgh Veterinary College, in which he tried to prove that pleuro-pneumonia is produced by atmospheric causes, but not by contagion.

A commission appointed in Prussia to investigate the cause and method of transmission of this disease reported in 1852, through Ulrich, that it was certainly contagious.

Notwithstanding this and much other experimental work, there were many in all countries who refused to accept the evidence, and, basing their conclusions upon clinical observation, they insisted that the disease was of spontaneous origin and not due to contagion. This contest over the cause of the disease led to intense opposition to suppressive measures and permitted the continued spread and destructive effects of the contagion. In Australia the contagion might have been stamped out if proper measures had been promptly enforced, but this seems to have been prevented by the obstinacy and active opposition of the noncontagionists. A pleuro-pneumonia commission was appointed to investigate the question of contagion, and while the commission investigated and gathered observations to establish the noncontagiousness of the disease the contagion leaped beyond the possibility of control, and to this day (1899) its ravages unfortunately continue among the herds of that great cattle-producing continent.

The members of the Australian commission were to a man noncontagionists, and they labored with all the strength of a preconceived opinion to prove their side of the controversy. They fetched healthy cows from Tasmania, where pleuro-pneumonia had never been, placed them in stalls beside diseased animals, inoculated them in various crucial ways, and then declared their inability to communicate the fever by contagion. They reported the result to the legislature, and based upon their failure an advice deprecating any further legislative interference. And yet the Government printer's ink was hardly dry upon their report when a counter report came from the butchers of Geelong, who had bought for slaughter the experimental bullocks, that the animals were all diseased, unfit for human food, and demanding back their money.¹

While the methods of this commission can hardly be taken as a model in all respects for scientific investigations, the evidence finally obtained from their experiments was nevertheless convincing, and, although the critical period when the disease might have been stamped out was allowed to pass without decisive action, the contagiousness of the disease is no longer seriously contested.

INVESTIGATIONS OF PLEURO-PNEUMONIA IN THE UNITED STATES.

In the United States the experience with pleuro-pneumonia was almost parallel with what occurred in Australia. Introduced in the vicinity of New York City in 1843, the disease appears to have been regarded as due to climatic conditions rather than contagion, and was allowed to slumber without attracting much attention until it was investigated by Gamgee in 1868 and 1869. In the meantime an importation of cattle from Holland had carried the disease to Massachusetts in May, 1859. Although the nature of the disease was recognized and brought to the attention of the legislature, the conta-

¹ Veterinarian, 1875, p. 681.

gion was allowed to spread for a year before authority was granted for its suppression. It was then necessary to slaughter 932 animals to dispose of all that were known to be exposed.

A year later it was found that some affected animals had eluded the commission and that the disease still existed. There now began a most remarkable series of delays, obstructions, and efforts on the part of misguided persons to prevent the eradication of the plague. Commissioners were appointed who did not believe in the existence of a contagious disease. The governor directed that experiments be made to test the question of contagion, and, as so frequently happens where scientific methods are not used, these were unsatisfactory. In 1864 the board of commissioners had again been reorganized and experiments were still in progress to test the contagiousness and curability of the disease. In 1865-66 it was stated that the commissioners had been so far successful that but few cases had occurred during the year. The experiments also seem to have had positive results, as it was reported that of six animals exposed four had certainly contracted the disease. In the report for 1866-67 the commissioners announce the extinction of the disease, the last cases having occurred in October, 1865.

The contagion which was imported at New York was, however, allowed to exist and spread until, in 1879, an effort was made by the States of New York and New Jersey to eradicate it from their territory. At this time the infection existed in Connecticut, New York, New Jersey, Pennsylvania, Maryland, District of Columbia, and Virginia. The efforts of the States were not well sustained and resulted unsuccessfully, though they served to attract attention to the danger which constantly menaced our cattle industry. The realization of this danger led Congress in 1884 to establish the federal Bureau of Animal Industry, the principal object in view being the investigation of the disease and the adoption of measures for its control.

There has been much skepticism expressed by influential persons as to the existence of pleuro-pneumonia in the United States, and doubt as to its contagious character in case the disease were found. Opinions of this nature were so freely declared that the Commissioner of Agriculture deemed it advisable to direct an experiment to be made which would once for all settle these questions. According to his instructions, new stables were erected upon an island easily accessible from the city of New York. There were but fifteen native cattle upon this island, and there was no history of any disease ever having appeared among them. When the stables were completed eighteen cows and thirteen calves were brought direct from Canada, a section where no disease having symptoms at all simulating those of pleuro-pneumonia had been observed, and were placed in the stables erected for this experiment. These animals were thoroughly examined by experts and found to be entirely healthy.

It was believed that by selecting an island where no lung disease of cattle had been known, in building new stables on well-drained land, and in bringing healthy cattle from a country where the disease had never been observed, the conditions of the experiment were such that the results would be absolutely reliable. To expose these animals in such a manner as to test the contagiousness of the malady, five cows selected in the city of Brooklyn as being affected with contagious pleuro-pneumonia were placed in the stable with the healthy Canadian cattle. As a result of this exposure by close association, twenty-two of the thirty-one experimental animals contracted pleuro-pneumonia between September 30, 1884, and January 3, 1885, a period of less than three and one-half months.

This experiment was convincing as to the existence and contagiousness of the disease. Within a comparatively short period 71 per cent of the exposed animals had become affected, and with a number of these the attacks were very acute and typical in symptoms and development, while the appearances of the lungs after the death of the animals were perfectly characteristic.

SUCCESS OF EXPERIMENTAL EXPOSURES AND INOCULATIONS.

This ended the experimentation with pleuro-pneumonia in the United States and furnished an incontestable basis for the rigorous sanitary measures which led to the final eradication of the contagion. What must appear to every reader as remarkable is the doubt as to the contagiousness of the disease which was so tenaciously held in every affected country. It appears as though clinical observation led more people to erroneous conclusions than to correct ones. And where such differences of opinion resulted from observation, how was the truth to be known? In every country the resort was finally to experimental exposures and inoculations, and the results of these have been clear and satisfactory. The measures formulated in harmony with the conclusions drawn from the experiments have been successful in extirpating the disease from the United States, Great Britain, and other countries, and the question of its contagiousness appears forever settled.

There have been numerous other questions that have been investigated, and the effort to discover the active agent of the contagion has been persistent and thorough. It has long been known that the serum, or exudate, of the diseased lung was virulent, and it has been extensively used for inoculation with the purpose of conferring immunity. The microscopic examination of this serum and the attempts to make cultures from it by the ordinary bacteriological methods failed to reveal any microorganism, and it is only recently that apparent success has been obtained by making such cultures in collodion capsules placed in the abdominal cavity of an animal a sufficient time for multiplication to take place. The microorganism obtained was

much smaller than any previously discovered and could not be defined with existing powers of the microscope.

ANTHRAX (OR CHARBON).

Accounts have come down to us from the earliest historical times of outbreaks of a plague affecting man and most species of animals which are identified by students of this subject with the disease now known as anthrax, carbuncular fever, malignant pustule, or charbon. Whether the plague described by Homer in the first book of Iliad and the sixth plague of the Egyptians were or were not manifestations of anthrax, may be open to some question; but by the beginning of the Christian era the descriptions became so clear that there is no reason to doubt the prevalence of anthrax at that period with substantially the same characteristics as it presents at the present day. During the long period of the middle ages frequent outbreaks are noted, which, with the revival of learning and the increasing attention given to professional studies, were more often mentioned. The eighteenth century is remarkable for the large number of epizootics of this nature which occurred in Europe.

EARLY DESCRIPTIONS OF ANTHRAX.

As might be expected, the diagnosis at that period was far less accurate than to-day, and it is not difficult to perceive that widely different diseases were sometimes confounded under the single term of anthrax. Thus, rinderpest was confused with anthrax during the eighteenth century and as late as the second quarter of the nineteenth, while blackleg, or symptomatic anthrax, and malignant edema have only been differentiated from it in recent years by bacteriological researches.

Chabert (1782) gave the first systematic description of the disease and pointed out the symptoms which were peculiar to it. He described three forms: (1) Anthrax fever, or internal anthrax, characterized by fever without external swellings; (2) essential anthrax, manifested by external swellings without preceding general symptoms; (3) symptomatic anthrax, characterized by fever followed by external swellings. The dark color of the blood and flesh, together with the severity of the symptoms, and the rapid course and fatal termination, were characters recognized from the earliest antiquity.

INVESTIGATIONS REGARDING THE CAUSE OF ANTHRAX.

As there are numerous and extensive districts where anthrax has been endemic and enzootic from time immemorial, and as it attacks nearly all varieties of animals and is readily contracted by man in caring for diseased animals, skinning carcasses, making post-mortem examinations, eating the infected flesh, handling the skins, or sorting the wool, the great number of cases attracted much attention and led

to constant efforts to discover the cause. The various investigators attributed the origin of the disease to about every condition to which the animals could possibly have been exposed. Some taught that it was due to small, badly ventilated, and unsanitary stables; others that it was caused by food of bad quality, forage and grain too recently harvested, or covered with rusts or molds; still others attributed it to the herbage of artificial pastures, clover, lucern, and corn; yet another class found its origin in atmospheric conditions, such as excessive heat and moisture; while, finally, there were those who, rejecting all of these conditions, found what they believed to be the true cause in the conditions of the soil, that is, in the moisture, the clay, and the lime, which were believed to coincide with the areas in which the disease was enzootic.

Renault and Reynal, authors of the article on charbon, in the "Nouveau Dictionnaire de Médecine, de chirurgie et d'hygiène vétérinaires," writing as late as 1857, after recapitulating these various theories, naively admitted that "the causes which give birth to anthrax are still enveloped in a certain obscurity, in spite of the researches of which they have been the object. Perhaps, even, it is true to say that this obscurity results from the large number of these researches and the different points of view of the observers who sought to study this disease. In fact there are almost as many special and different causes which have been assigned to it as there are particular treatises on the subject. It is here, above all, that the old aphorism is true: *Quot homines, tot sententiæ* [minds as many as the men]."

Nevertheless, from the beginning of the century physicians had observed that certain malignant pustules in man originated by accidental inoculation from animals affected with anthrax, or from their carcasses, and Barthélemy, in 1823, succeeded in producing the disease in horses and sheep by inoculation and feeding with anthrax blood. The following year Leuret communicated the disease by transfusion of blood from a diseased to a healthy horse.

These positive results were explained away by comparing them with the effects which follow inoculation with putrefying animal matters, and the most that was gained was the assumption of the putrid nature of the anthrax virus.

In 1836 Eilert obtained infection in every case by inoculation of blood from sheep to sheep, from sheep to horses, and from cows to sheep. The feeding of clover hay which had been moistened with infectious blood and afterwards dried in the sun killed two sheep out of three.

One of the studies of this disease was made in 1842, under the direction of the French minister of agriculture, by Delafond, an exceedingly able professor of the Alfort veterinary school. There had been for many years an enzootic disease affecting the sheep of La Beauce, province of Eure-et-Loir. This is a district with fertile soil, favorable

to animal production, and where sheep are raised and fed in large numbers. There was but one obstacle to the maintenance of this industry in a prosperous condition—the presence of the disease known as sang, coup de sang, maladie de sang, or sang de rate, which destroyed 20 per cent of the animals annually. The first fact observed by Delafond after reaching this section was that the disease most frequently attacked the animals which were youngest, which had been thriving in the highest degree, and which promised to be the best in the flock. Considering this fact in connection with the fertility of the soil, the abundance and the quality of the crops, and the liberality of the feeding, Delafond reached the conclusion that the disease was only a condition of plethora, an excess of blood circulating in the veins, and, above all, a predominance of red globules in this liquid. He analyzed the soil, proving its fertility favorable to the production of forage rich in nutritive principles; he analyzed the blood, showing this to contain a high percentage of albumin, fibrin, and red globules; he analyzed the plant food and found this, as he predicted, having a high nutritive value; he examined the sick animals and the carcasses of the dead ones, finding the distended blood vessels, the thickness of the blood, the frequent hemorrhages, the swollen spleen, the congestion and dark color of the other organs, all apparently uniting to establish his theory that the disease was plethora, caused by too rich and too abundant food. The frequent development of malignant pustules in persons who handled the dead carcasses or their products he explained as due to a septic or anthracoid alteration of the blood, resulting from insufficient ventilation of the stables and the inhalation of putrefactive gases.

H. Bouley afterwards remarked concerning the above report:

Nothing proves better than this document, remarkable for the logic of its deductions, but the premises of which were a fundamental error, how difficult it is to seize and interpret the relations of things when one has no other basis for judgment than that which observation alone can furnish. Delafond had found a part of the truth when he established a relation between the food supply and the aptitude of the sheep to contract the disease. But observation could not conduct him further and give him an accurate notion of this *maladie de sang*. It was necessary to resort to experimentation, and it was because he did not invoke this method that his researches led him into error, and that he only saw plethora in this disease of La Beauce, the identity of which with anthrax was soon afterwards recognized.

It was but ten years later (1852) that Boutet read before the Academy of Medicine of France a report of an experimental study of this disease of La Beauce. He showed that the disease might be communicated by inoculation, by transfusion of blood, by direct contact, and exceptionally by cohabitation. It was not only communicable to sheep, but to horses, cattle, and rabbits. The sang de rate of the sheep, the sang, or anthrax fever, of cattle, the anthrax fever of the horse, the malignant pustule of man were shown by these inoculation

experiments to be one and the same disease. It was also shown that the contagion resided in all the organs and liquids of the body and that it might be inoculated from animal to animal indefinitely without losing its virulence. Here at last was something definite and tangible in regard to this disease, a foundation of fact upon which to build by future researches.

In 1845 and 1846 Gerlach had published papers giving accounts of further experiments proving the contagiousness of anthrax and showing the persistence of the contagion in the soil three years after the burial of carcasses of animals dead of this disease. In 1850 Rayer and Davaine called attention for the first time to the presence in anthrax blood of small filiform bodies, in length about twice the diameter of a blood globule and without spontaneous movements. In 1855 Pollen-dar stated that he had observed since 1849 the little rods mentioned by Rayer and Davaine, and that they possessed the histochemical reaction of a vegetable substance. He was unable to determine whether there existed any relation between the presence of these bodies and the virulence. These rod-like bodies were again mentioned by Brauell in 1857, who not only observed them in the blood of men and animals which had died of anthrax, but saw them in the blood before death, and concluded that their presence confirmed the diagnosis and warranted the prediction of early death. Brauell did not suspect that these bodies caused the disease, but, on the contrary, was of the opinion that they were transformed after death into the mobile vibrios of putrefaction.

In 1860 these little rods of charbon were studied by Delafond, who confirmed their significance in the diagnosis and prognosis of the disease when they were found in the blood of sick animals. He observed, further, that when the blood containing these bodies was preserved in small glass vessels in contact with the air they developed in the course of four days to two or three times their original length, while preserving about the same diameter. In eight or ten days their length was quadrupled or quintupled. These experiments having satisfactorily demonstrated that the anthrax filaments were an organic vegetable substance, he tried to obtain a complete development of this organism, that is, to make it produce spores or grains. In this he failed, but he concluded it was extremely probable that there circulated some time before death in the blood of animals affected with anthrax, multiplying prodigiously, vegetable filaments which might develop when the blood was drawn from the veins and placed in conditions favorable to vegetation, producing a very remarkable mycelium formed of numerous delicate filaments. He did not dare to decide whether the anthrax rods were the cause or the effect of the disease. Nocard and Leclainche remarked that the sarcasm with which these too advanced views were received is sufficient to explain his timid hesitation.

APPLICATION OF THE GERM THEORY TO ANTHRAX.

The publication in 1859 of Pasteur's memoir on butyric fermentation threw new light upon the development and effects of the micro-organisms, and led Davaine to apply the "germ theory" to anthrax, which he did in papers published during the years 1863 and 1864. This was a great step in advance, as previous to that time there was not only ignorance of the cause of anthrax, but of all contagious diseases. The nature of contagion was the *bête noire* of the medical profession. It was the one thing that appeared unattainable, either through the reagents of the chemist or the apparatus of the microscopist. There is consequently no need for wonder that when an investigator claimed to have pierced the impenetrable veil that for all time had shrouded this subject, he was met with the most pronounced skepticism and the keenest criticism.

For thirteen years the discussion continued without much progress either against or in favor of the new theory. New facts were produced, some of which apparently had a bearing in one direction and some in the other. Davaine's conclusion was still but a hypothesis or conjecture without positive evidence to sustain it. This was the condition of the subject when Koch published his remarkably able paper on the subject in 1876. He began by a study of the biology of the anthrax rods, finding that in the liquids of living animals they multiplied rapidly by lengthening and dividing, and that although he inoculated them from mouse to mouse for twenty consecutive times, no other forms were produced. In the blood and juices of dead animals or other favorable nutritive liquids, with admission of air and between certain extremes of temperature, they grew into extraordinarily long threads, with the formation of numerous spores. These spores, placed in a suitable liquid under favorable conditions, germinate and produce again the bacillus threads.

The bacillus threads or filaments are delicate and easily destroyed. A few days in an unfavorable temperature, a similar period deprived of air, diluting the fluid containing them with a large quantity of water, or drying the substances containing them was sufficient to destroy their vitality. On the other hand, the spores are very resistant, and when once formed are capable of existence under the most unfavorable conditions. These facts furnished the clew by which Koch was able to demonstrate the agency of this particular organism in causing the disease known as anthrax.

When fresh anthrax blood was preserved without contact with the air till the filaments died, the fluid at once lost the power of communicating the disease, as shown by inoculation experiments. On the other hand, with the admission of air under otherwise identical conditions, the organism grew, formed spores, and the liquid retained its virulence indefinitely. Again, by admitting air, but by keeping the fluid in a temperature of 8° R., which prevented the formation of

spores before the rods died, the virulence was again lost. So by drying rapidly or by diluting with much water the death of the bacilli resulted and the activity of the liquid disappeared. Koch further showed that when spores had once formed, neither cold, nor deprivation of oxygen, nor drying, nor dilution with water any longer destroyed the virulence of the anthrax liquids.

Here was a scientific demonstration of the identity of this micro-organism with the active principle of the infectious liquids. It showed that while the bacillus or its spores retained vitality the contagion existed, and when the bacillus lost its vitality without forming spores the contagion disappeared. The connection between the bacillus and the contagion was established beyond reasonable doubt.

The publication of these facts placed the germ theory of contagion upon a solid foundation which neither the storms of criticism nor the earthquakes of negative evidence have been able to destroy.

The first objection raised to this theory was that when the blood first becomes virulent no bacilli can be discovered by the most careful microscopical examinations; if the bacilli were the cause of the disease they should be apparent as soon as the blood is capable of communicating it by inoculation. Pasteur explained this fact as due to the difficulty of discovering one or two bacilli in such a large surface as is made by a drop of blood under the higher-power lenses. For instance, a drop of blood pressed flat between the object glass and thin cover presents a surface of one-half inch in diameter; this magnified only 500 diameters gives a surface with a diameter of 20 feet. And this is sufficient to fill the field of vision nearly 1,800 times. The accuracy of this explanation was proved with culture experiments, by showing that whenever the blood was virulent a drop of this blood added to a suitable culture liquid would produce an abundant growth of the bacillus.

The distinguished investigator, Paul Bert, took up the subject, and read a paper before the Académie des Sciences, in which he showed that compressed oxygen, which was supposed to kill all living things, did not destroy the anthrax virus, and that blood treated with it would still yield an alcoholic extract capable of producing anthrax. Now, absolute alcohol, as well as compressed oxygen, had been supposed to be fatal to all life. If, then, the virus survived both the action of compressed oxygen and solution in alcohol, he reasoned it was because it was not a living organism, but a chemical agent allied, perhaps, to diastase.

Once more the genius of Pasteur was equal to the occasion, and he demonstrated, to the satisfaction of Bert, that although the bacilli were destroyed by the agents he had used, their spores were not. He subjected Bert's alcoholic extract to microscopic examination and proved the presence of large numbers of these spores. Bert afterwards found that such spores preserved for five months in ordinary alcohol were as virulent as at first.

THE GERM THEORY ESTABLISHED.

The great contest over the germ theory of disease was settled by the experiments reported in 1876 and 1877, and the way was open to apply this great discovery to practical medicine. What a revolution in medical thought and practice has resulted can be appreciated only by comparing the text of medical works of twenty-five years ago with that of the present day. There were some individuals, however, who could not understand the difference between positive and negative evidence, and who did not for years fully grasp the fact that the germ theory was established. These persons continued to raise objections, and some of them are still telling us that investigators have gone mad over bacteriological studies and that the whole structure which they have raised during the last quarter of this century is doomed to crumble and disappear. Such objectors can have little effect upon the progress of science at this day, since every student has learned that a fact once established by positive evidence is as solid as the mountains and endures for all time; yet, many will die without accepting the germ theory, just as numerous contemporaries of Harvey died disbelieving in the circulation of the blood, but the recorded facts and the demonstrations of the germ theory will stand, as Harvey's discovery has stood, and it is as fruitless to inveigh against them as to attempt to sweep back the rising tide with a broom.

Many practical results in the treatment of anthrax outbreaks have followed the discovery that it is caused by a particular microscopic organism which we now know as the *Bacillus anthracis*. It has been recognized that this bacillus may multiply in the soil and in stagnant water; that its spores may retain their vitality and virulence after remaining in the earth for many years; that these spores form in the carcasses of dead animals and are brought to the surface from the pits where such carcasses are buried through the agency of earthworms; that disinfection, as it was practiced previous to 1876, was ineffectual in destroying the spores of this microbe, and that more active agents were required; that the essential condition which keeps up the disease is not the character of the soil, not the condition of the atmosphere, not the defects of the stable, but the presence of the bacillus in the soil of the pastures and upon the forage gathered from infected fields; and, finally, that the bacillus may be attenuated and form a vaccine which will in most cases grant immunity and protect animals from the infection. The use of this vaccine is increasing, and has reduced the mortality in the infected districts from an average of 10 per cent with sheep to less than 1 per cent, and from 5 per cent with cattle to less than one-half of 1 per cent.

BLACKLEG* (SYMPTOMATIC ANTHRAX).

This disease, which is characterized by a rapidly developing swelling, with the abundant formation of gas in the tissues of the affected

part, is seen principally in cattle, and until recent years was supposed to be identical in cause and nature with anthrax fever. The swelling appears most frequently in the upper part of the limbs, and when cut into is found filled with blood and very dark in color; hence, the name blackleg, by which it is commonly known in the United States. It is a common disease and almost invariably fatal.

DESCRIPTIONS OF BLACKLEG FROM OBSERVATIONS.

When Chabert wrote his classical description of anthrax in 1782, as we have already seen, he divided it into three clinical forms: (1) Anthrax fever, or internal anthrax; (2) essential anthrax, manifested by external swellings without preceding symptoms of fever; (3) symptomatic anthrax, beginning with fever and soon followed by external swellings. In the first division there could only be included cases of true anthrax, but in the second and third divisions there were brought together those forms of anthrax in which the virus penetrated the skin or mucous membrane and formed a visible swelling at the point of entrance, and also the swellings due to the contagion of an entirely distinct disease now known as blackleg, or symptomatic anthrax.

In general, the anthrax swellings precede the fever, while with blackleg the swellings frequently precede and often follow the fever. Chabert's classification, while a great advance from the ideas of his predecessors, was in this respect artificial and inaccurate, but was nevertheless the accepted interpretation of the facts for nearly a century.

There was little advance in the knowledge of this subject until 1856, when Walraff described an emphysematous form of anthrax, thus calling attention to the essential difference between the clinical symptoms of the anthrax and blackleg tumors, but he apparently did not suspect that they were distinct diseases. Bollinger in 1873 and Feser in 1875 pointed out marked differences, and Schindler and Weber in 1876 again called attention to the disease characterized by these emphysematous, or gaseous, tumors, and expressed their opinion that it should be differentiated from anthrax, since no case of its transmission to man had been observed, although the skins of affected animals were utilized, and the flesh even was consumed by the inhabitants of the infected districts in the Alps.

These opinions were not generally accepted, or at the best were regarded as of the nature of conjectures rather than demonstrations.

The divergent views expressed by different authorities and the apparent inconsistency of the observations served to increase the confusion rather than to bring order and light into the controversy. It had been observed that anthrax fever was often communicated to the men who handled the carcasses or skins of animals which had died of the disease, and that such accidents never occurred from the emphy-

sematous tumors of symptomatic anthrax. In attempting to learn the reason for the transmission in one case and apparent noncontagiousness in the other, when both were regarded as essentially the same disease, inoculation experiments were made which showed that anthrax fever was regularly communicated from animal to animal by inoculation with the blood of an affected animal, while the blood of animals affected with symptomatic anthrax was not virulent, and material from the diseased tissues failed to communicate the disease in the great majority of cases. Did these facts indicate that two distinct and separate diseases existed where but one had previously been recognized? or, did they simply mean that in anthrax fever the disease was generalized and the contagion circulating throughout the body, while in symptomatic anthrax the contagion was localized in the swelling, which was the principal symptom of the morbid condition, and that it was here modified by septic complications?

THE NATURE OF ANTHRAX DEMONSTRATED BY EXPERIMENTS.

This question could not be answered by observation alone, nor were those who attacked it by experimentation able to solve the difficulties until the inspiration which followed from the investigations of Koch and Pasteur pointed the way. The demonstration that the *Bacillus anthracis* is the cause of anthrax fever, the clear description of its form and biological characters which enabled the investigator to identify it with certainty, and the methods of cultivating and studying bacteria introduced at this period made it possible for Arloing, Cornevin, and Thomas to carry out the brilliant series of experiments which demonstrated that anthrax fever and symptomatic anthrax were entirely different and distinct diseases.

These investigators published their first paper in 1879, three years after Koch had shown that anthrax fever was caused by the *Bacillus anthracis*, and when it was well known that the bacillus was easily found in the blood and tissues of animals which had died of that disease. They announced that careful microscopic examination and cultures, according to Pasteur's method, failed to reveal the *Bacillus anthracis* in the tumors or in the blood of animals affected with blackleg either before or after death. They also made thirty-four inoculations, using three young cattle, three sheep, two horses, and twenty-six rabbits and mice. All of these failed to communicate the disease. They therefore concluded that neither the blood nor the liquids of the tumors or affected lymphatic glands, in cases of symptomatic anthrax, contained either the *Bacillus anthracis* or its spores.

In later communications it was shown that blackleg is inoculable from animal to animal, and that the failures of the earlier inoculation experiments were partly due to the use of insusceptible animals. Cattle, sheep, goats, and guinea pigs readily contract the disease. Horses, swine, dogs, cats, rabbits, and fowls are either immune or

have a great power of resistance toward this virus. Even cattle, the species in which this malady develops most frequently under natural conditions, are not susceptible at all ages. Calves under three months old and cattle over four years were found to have a high resisting power.

It was also necessary to determine experimentally the parts of the body in which the virus existed in most concentrated form. The blood is not virulent until just before death, and then, like the serum from the tissues surrounding the tumors, often fails to communicate the disease. The liquid of greatest virulence is obtained from the most discolored and darkest parts of the tumor, though the bile and amniotic liquid are both quite active. Further, it was found that a certain dose of virus must be used, and that this should be inserted into favorable portions of the body in order to obtain uniform results.

Microscopic study of the virulent liquids revealed the constant presence of a rod-shaped microorganism, which is endowed with power of active motion and having in many cases a spore at one end. The first attempts to cultivate this germ were not successful. It would not multiply in the presence of oxygen, as it belonged to that class of organisms known as anaerobic, and it required liquids of special composition to favor its growth. These difficulties overcome, it was found that the bacillus could be grown through many generations and retain its virulence indefinitely with proper conditions of environment.

BLACKLEG AND ANTHRAX COMPARED.

The bacillus of blackleg differs remarkably in some respects from that of anthrax. While the former is anaerobic and forms spores within the body of the living animal, the latter is aerobic and can form spores only after it has come in contact with the air. These peculiarities in the microbes explain the remarkable differences in the resisting powers of the two forms of virus under varying conditions. The spore being the resting stage of the bacillus and the form in which it is most resistant to unfavorable conditions, it is clear that, if this microorganism is the true cause of the virulence, the virus should retain its active properties longer and be more difficult of destruction when it contains spores than when rods alone exist. This is exactly what was found to be the case, and it explains why a disinfectant which will destroy the contagion at one time will not do so at another.

The contagion in fresh anthrax liquids, as they contain no spores, is destroyed in a few minutes by a temperature of 58° C., while fresh blackleg virus, always containing spores, requires a temperature of 100° C. for twenty minutes to produce the same effect. And on account of this ever-present spore the blackleg virus more surely resists the influence of putrefaction and other unfavorable conditions, and is therefore one of the most difficult to eradicate of all the known forms of contagion.

Comparing anthrax and blackleg experimentally, it was found that the former was easily communicated by scarifications or pricking the skin with a lancet charged with the virus, while the latter was only exceptionally transmitted in this manner. When inoculated into the connective tissue the local lesion produced by anthrax virus in most cases consisted of a small inflammatory area, with slight accompanying edema, while blackleg virus similarly inoculated caused an enormous swelling, with abundant edema. Again, the inoculation with anthrax virus into the veins is more dangerous than when inserted into the connective tissue, and is fatal with infinitesimal doses. On the contrary, blackleg virus may be inoculated into the veins in much larger doses than into the connective tissue without producing fatal effects. It was shown that one attack of either of these diseases granted immunity from that particular contagion, but that an attack of anthrax did not protect from blackleg nor did an attack of blackleg protect from anthrax.

REMEDY FOR BLACKLEG.

The above experimental studies consequently established the fact beyond controversy that two distinct diseases had previously been grouped together; that the germs of these two diseases were distinct and very different in their biological characters, and that different measures were required for their control.

These investigators did not stop at this point, however, but continued their researches with a view of finding a prophylactic treatment. The remarkable success of Pasteur in attenuating the virus of anthrax and fowl cholera led them to endeavor to produce an attenuated virus, or vaccine, for blackleg. This was finally accomplished by drying the virulent flesh and afterwards reducing it to a powder and subjecting it to a temperature between 85° and 100° C. for a sufficient time to properly reduce its activity. This vaccine, perfected by years of experience, is now in use in most parts of the world. It is supplied by the Bureau of Animal Industry to the stock raisers of the United States to the extent of half a million doses a year, and where used has reduced the losses on infected pastures from 10, 15, or 20 per cent, which annually occurred before using, to less than 1 per cent per annum.

This great practical triumph in the control of an infectious disease is due entirely to the application of the experimental method. Without experiments upon living animals and confined to clinical observation, it was impossible to determine whether anthrax and blackleg were essentially identical in nature or whether they were distinct diseases, and much less was it possible to isolate and identify the germ or so to change the activity of this organism as to transform it from one of the most deadly organisms to a harmless protective vaccine.

TEXAS FEVER, SPLENETIC FEVER, OR SOUTHERN CATTLE FEVER.

HISTORY OF TEXAS FEVER.

In 1814 we find the first known accounts of a disease being disseminated by apparently healthy cattle from certain districts in the Southern States when these cattle were driven North to market. Attention was at that time called to this phenomenon by Dr. James Mease in a lecture before the Philadelphia Society for Promoting Agriculture, who stated that the cattle from a certain district in South Carolina so certainly diseased all others with which they mixed in their progress to the North that they were prohibited by the people of Virginia from passing through the State; that these cattle affected others while they themselves were in perfect health, and that cattle from Europe or the interior taken to the vicinity of the sea were attacked by a disease that generally proved fatal. In a paper read before the same society in 1825 he says: "The circumstance of cattle from a certain district in South Carolina affecting others with this disease has long been known."

The precise locality from which these cattle originated, or its extent, he was, however, unable to ascertain, notwithstanding inquiries upon the subject.

Dr. Mease gave an account of an outbreak of this disease which occurred in 1796 in Lancaster County, Pa., as a result of South Carolina cattle being brought and sold there. These cattle were penned over night in a plowed field and did not come in contact with the cattle on the farm; nevertheless, the latter commenced dying a short time afterwards. In every instance where sold they communicated the disease to the cattle with which they mixed. The symptoms were loss of appetite and weakness of the limbs, amounting to inability to stand; when they fell, they would tremble and groan violently. Some discharged bloody urine, others bled at the nose. On being opened the kidneys were found inflamed and sometimes in a state of suppuration.

Many similar outbreaks occurred in North Carolina, Virginia, and Maryland in the first half of the century, but the accounts of them are too meager to be of use. Legislation was enacted in North Carolina, however, as early as 1837 to prevent the driving of cattle into that State from either South Carolina or Georgia between the first day of April and the first day of November; also, to prevent cattle from being driven from those parts of North Carolina, where the soil is sandy and the natural production or growth of timber is the long-leaved pine, into or through any of the highland parts of the State, where the soil or growth of timber is of a different kind, between the dates already mentioned.

Very little more was heard of this disease until about 1850, when cattle bred in Texas began to be driven through Arkansas, Missouri, and Kansas for distribution to feeders in those and other Western

States. A mysterious and highly fatal disease then appeared along the great roads, highways, or trails over which these cattle were driven, destroying about 50 per cent of all the native cattle. Persons living near the fording places lost as high as 90 per cent. It was two years before the origin of this disease was traced to the Southern cattle.

From 1856 to 1860 many Texas cattle were driven into the States of Kansas, Missouri, Kentucky, Iowa, and Illinois, and it was stated that the native stock in the sections to which they were taken were swept away by a "dry murrain." An epizootic under such circumstances was so unexpected and contrary to all previous experience that at first the source of the disease was not suspected, and when the Southern cattle were accused there were many who looked upon their presence as a mere coincidence. However, by 1861 the conviction that Texas cattle disseminated disease became so strong that laws were enacted by the States of Kansas, Missouri, Kentucky, and Illinois regulating the movements of Southern cattle.

The disease ceased in these States during the civil war and its ravages had apparently been forgotten, when it reappeared during 1866, 1867, and 1868 with the first droves of cattle from Texas. There was little attention given to it at first, as the number of cattle driven in 1866 and 1867 appears not to have been very large. In 1868, however, the markets and other conditions were more encouraging to those who handled this class of stock, and large herds of Texas cattle were sold for feeding in Illinois, Indiana, Ohio, Pennsylvania, New York, and other Northern States.

As the hot weather of summer came on the disease broke out wherever the Southern cattle had been taken. Of 320 head of native stock shipped from one farm to the East for slaughter, 224 died before they reached their destination, and the remainder were said to have been sent to the rendering tanks. At the little town of Tolono, Ill., from 15,000 to 18,000 Texan cattle were landed. The fever commenced its destructive work about July 20, sweeping away nearly every native animal of the bovine race in that section. Nine hundred and twenty-six head of cattle died in that township, which polled but a trifle over 200 votes, and 5,000 head succumbed in the county. Within 2 miles of the Chicago stock yards, according to the report of the medical officer of the city, but 1 cow escaped, 161 animals having perished. In the vicinity of Loda, Ill., it was estimated that not less than 1,800 cattle died. In Warren County, Ind., the losses reached about 1,500 head; in Jasper County, 400 head; in Marion County, 100 head.

These losses are simply examples of what was occurring in many parts of the Northern States. The disease was soon traced to the Southern cattle, and in the absence of specific knowledge concerning its character there was great alarm as to the extent to which it might spread and its effect upon the public health. While the direct loss from the disease was very heavy and brought disaster to many indi-

viduals, the contagion was fortunately one which did not spread from the sick native cattle, and was consequently self-limited. It was also a disease that is not communicable to the human species, and hence did not appreciably affect the public health.

INVESTIGATIONS OF TEXAS FEVER BY THE DEPARTMENT OF AGRICULTURE AND
BOARDS OF HEALTH.

The excitement and interest aroused by the outbreak of 1868 led to extensive investigations by the Department of Agriculture and by the boards of health of Chicago and New York. These researches were sufficient to establish the symptoms, the post-mortem lesions, and some of the peculiarities in regard to the transmission of the disease. It was shown that there was intense fever, with a temperature ranging from 105° to 110° F., accompanied by great weakness and prostration. The ears and head drooped, the hind legs were advanced under the body, and the fetlocks were partially flexed, constituting, when taken together, a more or less characteristic attitude. The urine, at first tinged with red, became deeper colored, until it had the appearance of undiluted venous blood. On post-mortem examination the liver and spleen were found to be the organs most seriously affected. Both were congested and enlarged. In the liver there was bile-stasis in the ultimate biliary canaliculi, which were found distended and occluded, while the spleen was greatly engorged with blood, and its interior was transformed into a dark semifluid mass. The kidneys, also congested, presented numerous blood extravasations in the pelvic portion.

A study of these symptoms and lesions threw little light upon the nature of the disease. The condition of the spleen suggested that it might be allied to anthrax, but there was an absence of the gelatinous exudations seen in that disease, and, moreover, there was no case of the transmission of the malady to mankind. The course of the disease was also longer than in anthrax fever. A consideration of the phenomena observed relating to the transmission of the contagion only served to deepen the mystery. The cattle from the South which brought the disease were themselves apparently healthy. The sick Northern cattle did not communicate the disease. The contagion in most cases was confined by ordinary farm fences, and, indeed, it appeared to be the ground over which the Southern cattle had traveled rather than the cattle themselves which was dangerous to susceptible animals. And this infected ground retained its power to communicate disease until it was purged by the frosts of approaching winter.

Strange to say, the pastures did not always become dangerous immediately after the Texas cattle had traveled over them. In some cases it was observed that susceptible cattle had fed upon such pastures for a month or more after the Texas cattle had left them, and had then been removed to other fields without sustaining any injury,

while other Northern animals of the same lot allowed to remain a few weeks longer suddenly developed the disease in a most violent form. How different from the phenomena of other contagious diseases were these manifestations! and how inexplicable in the light of the medical knowledge of that day! Of what did this contagion consist that it could be propagated by well animals and not by those affected with the disease; that it could remain upon pastures inactive and resist sun and rains for weeks and then suddenly attack in the most virulent form all Northern animals that so much as walked across them, while it respected the animals from the South? Surely they were justified who called this a "romance in pathology," since these phenomena were without precedent and to the most enlightened appeared incredible.

These investigations of 1868 and 1869 established the more apparent characteristics of the disease, though for sixteen years afterwards there were scientific men who tried to prove that no such disease existed. During all this time the cattle driven from Texas and Indian Territory to the Northwestern States and Territories for grazing left a deadly trail behind them, which was destructive to the native cattle that crossed it. The stock yards and stock cars became more and more infected, and cattle purchased in the public markets and taken back to the farms for feeding were in so many instances found to have contracted the disease that purchasers avoided such places as much as possible. Even our export cattle that were given the greatest care en route became infected, and as many as two or three hundred would sicken on a single ship. This brought American cattle into disrepute and threatened to lead to annoying restrictions or even prohibition by foreign governments.

TEXAS FEVER DISTRICT DEFINED AND EFFORTS TO SEPARATE INFECTIOUS CATTLE.

The almost intolerable condition described above existed when the writer took up the study of Texas fever in 1879.

The first questions were: How shall this difficult problem be attacked? and, What methods of investigation shall be adopted? One question that appeared possible of solution had reference to the extent and the exact boundaries of the district from which the cattle came that spread the contagion. This could be determined partly by collecting all the information possible as to outbreaks of Texas fever in the Northern States and ascertaining exactly where the cattle came from which caused them, and partly by ascertaining the sections of the Southern States where Northern cattle imported to improve the stock were liable to die with acclimation fever, a disease which the writer had shown to be synonymous with Texas fever.

By pursuing these lines of investigation a great section of the country was found to be already invaded by the infection. This section included half of Virginia, the greater part of North Carolina,

all of South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, and large portions of Tennessee, Indian Territory, and Texas. The defining of this district made it possible to separate the infectious cattle in the cars and pens, while in transit, from the Northern susceptible cattle, and thus tended to lessen the spread of the contagion. However, there were many difficulties in enforcing regulations for this purpose, as there was no way of distinguishing between these different classes of animals when they reached their destination, and the waybills and car marks could not be implicitly relied upon. It was also desirable to know of what the contagion consisted, how it was disseminated, what disinfectants could be used to destroy it and in what strength these should be present to be active, what was the true period of incubation, what measures could be adopted to reduce the losses among pure-bred cattle taken to the Southern States to improve the stock, and what safeguards could be thrown around cattle from the infected district when taken North for grazing so that they would not destroy the animals in the sections to which they were permitted access.

The people of the South said: "What right have you to put restrictions upon our cattle when they are going to market? There is no disease among our cattle; and if the Northern cattle sicken and die, the loss should not be charged against our healthy cattle, the presence of which in certain cases was probably a mere coincidence." These arguments were difficult to meet, doubly so when the cases went to the courts, and it became necessary to explain the part played by the Southern cattle in originating the disease. Here, as in many other cases, observation of the outbreaks which developed spontaneously failed to reveal the mysteries, and it was necessary to question and cross-question nature through experiments in order to obtain the information which she withheld from the ordinary observer.

CONJECTURES AS TO MANNER OF DISSEMINATION OF TEXAS FEVER.

There were numerous conjectures as to the manner in which the contagion was disseminated. Some thought that in driving the Southern cattle such long distances their feet became worn, sore, and ulcerated, and that the discharge from these ulcerated surfaces poisoned the grass and developed contagion. It was believed that this hypothesis was confirmed by the known fact that the Southern cattle apparently lost the power to transmit the disease after they had been upon the Northern ranges sixty to ninety days. Another conjecture was that the contagion resided in the saliva and was distributed over the grass while the infectious animals were grazing. It was also contended by some that the Texas cattle became infectious by drinking from pools of stagnant water, particularly that which contained alkali, and that the infection was distributed with the urine and excrement. Still another conjecture was that the ticks, with

which most of the Southern cattle were covered, passed from these to the Northern animals, and the latter, not being accustomed to their bites, became affected with and died from the irritation and fever thus induced. A modified form of this hypothesis was also held, to the effect that the ticks dropped from the Southern cattle laid their eggs in the grass; that myriads of young ticks hatched, covered the herbage, and were taken into the stomachs of the cattle with the food, causing inflammation of the digestive organs, fever, and death.

How were we to decide which, if any, among these divergent views was the correct one? The writer was asked to make a hasty examination of the subject and prepare a preliminary report for publication. This he did, and it is at least instructive as to methods to read his views concerning the part played by the ticks in the transmission of the contagion. The following appeared to be extremely good arguments at the time the report was written (1880):

The tick theory.—One of the most widely spread opinions in regard to the causation of Southern fever is the pathogenic influence of the ticks with which Southern cattle are generally covered and which migrate in large numbers to the bodies of other cattle with which they mix. But the acceptance of this view is simply an evidence of the desire of the human mind to explain the origin of mysterious phenomena. The same principle is exhibited in the popular views regarding the pathogenic nature of *hollow horn*, *hollow tail*, *wolf teeth*, *black teeth*, *hooks*, etc., none of which have the least foundation in fact or reason. The tick theory scarcely explains a single one of the many peculiar phenomena of the disease. Ticks are found everywhere, but are simply more numerous at the South. Their attacks are not confined to the latter half of the summer, nor would they be likely to remain on a pasture from spring till August without doing harm and then suddenly cause an outbreak of the disease. Again, the post-mortem examination plainly indicates the cause of the disease to be an agent taken into the circulation and causing the most important changes in the composition of the blood.

Alas, for the limitations of human observation and reasoning when we fail to establish our premises by rigid experimentation! It has since been shown by experiments, outlined by the writer and carried out successfully by his direction, that the ticks do transmit the contagion of Texas fever, and that all of the mysteries connected with this transmission are explained by an accurate knowledge of the biology of the particular tick involved (*Boophilus bovis*), and of the other parasite (*Pyrosoma bigeminum*), which cooperates to produce the pathogenic effect.

EXPERIMENTS TO DETERMINE THE CAUSE AND DISSEMINATION OF TEXAS FEVER.

The first step toward revealing the nature of the disease was evidently to determine if it could be inoculated from animal to animal. If this question were decided in the affirmative, it would be possible, by continuing the inoculation experiments, to determine how widely the virus was distributed through the body, and with what secretions or excretions it was disseminated by the affected animal. It might

also be possible to identify a microorganism as the essential cause and to study its biology.

With these purposes in view, the writer, in 1879 and 1880, inoculated six head of cattle and drenched with liquids three that appeared most likely to contain the contagion. Two of these animals had an attack of fever, one being so seriously affected that it became quite weak and emaciated. In 1882 three more animals were inoculated, one of which became sick in ten days and died three days later of acute Texas fever. This was the first demonstration of the inoculability of the disease, and it proved that a mixture of blood and splenic pulp contained the contagion.

In 1886 Dr. Smith, in studying microscopic preparations from the spleen of an animal that had died of the disease, observed peculiar bodies in the red corpuscles which were suggestive of parasitic microorganisms. In 1888 and 1889 further studies of these bodies were made, which led to the conclusion that they were protozoa. As the most prominent feature of the disease was found to be a breaking down and destruction of the red corpuscles, and as these parasites existed almost exclusively in the red corpuscles of the blood, there was some reason to think they might be the cause of the disease.

At this period, having completed the survey of the permanently infected district, the writer observed that this district corresponded almost exactly with the habitat of the tick (*Boophilus boris*), which was almost invariably found to infest the cattle that were capable of transmitting the disease. Taking this coincidence, with the strong belief held by many cattlemen of experience, that the ticks had something to do with the production of the disease, it was determined to have this aspect of the question fully investigated. Dr. F. L. Kilborne, who was at that time in charge of the Bureau Experiment Station, was consulted and given explicit instructions to carry through one or more series of experiments with this object in view. The first experiments were made in 1889, and the result was: (1) That Northern cattle pastured in a field with cattle from the infected district which were infested with ticks contracted Texas fever; (2) that Northern cattle pastured in a field with cattle from the infected district that were carefully freed from all ticks by hand picking did not contract Texas fever; (3) that Northern cattle pastured in a field where no cattle from the infected district had been, but over which had been scattered a large number of ticks, contracted Texas fever.

The result of these experiments was a distinct and positive advance in our knowledge of the disease. It was now known (1) that the disease was inoculable; (2) that the blood of diseased animals contained a microscopic protozoan parasite; (3) that ticks picked from Southern cattle and spread upon pastures were a means of communicating the infection.

It was next important to learn in what manner the ticks conveyed the

contagion. From a medical point of view the most plausible theory was that the biting parts of the ticks became soiled with the blood of the Southern cattle, and that these contaminated ticks, migrating to susceptible cattle, carried the virus and inserted it when they began sucking blood from the latter. A study of the life history of the tick showed, however, that this theory was not consistent with the facts. The ticks do not leave one animal and go to another. When they are once upon an animal they remain there until they become mature, and then they drop off, lay their eggs on the surface of the ground, and die. There is no opportunity for this parasite to carry blood directly from the Southern to the Northern animal and inoculate it.

Another hypothesis was that with the blood sucked from Southern cattle the tick took into its body the virus of the disease, and that when the mother tick died and became disintegrated upon the pastures the contagion was liberated and the grounds infected. This supposition was entirely demolished by experiments which proved that the disease was caused by young ticks hatched from the eggs of the mature ticks which developed upon the Southern cattle, that is, the contagion is in some manner transmitted from the adult tick through its egg to its progeny, and this progeny has the power of inserting the contagion into the circulation of the cattle upon which it happens to fasten itself.

These facts threw much light upon the propagation of the malady, but they were not sufficient to establish a scientific theory explaining the transmission. Indeed, it was yet to be proved that the Southern cattle carried the protozoa in their blood. Microscopic examination was not sufficient to decide the question. A few minute points were observed in the red corpuscles of Southern cattle, but these points were much smaller and far less numerous than the protozoa in sick Northern cattle. The Southern cattle, besides, were in good health, and it seemed improbable that they harbored so deadly a parasite.

There was but one way to decide as to whether Southern cattle carried this contagion in their blood, and that was to inoculate susceptible Northern cattle with the blood of Southern cattle. This experiment was made, and it demonstrated that a comparatively small quantity of blood from a Southern cow, injected under the skin or into the veins of Northern cattle, produced an acute attack of Texas fever. In Northern cattle infected in this manner the protozoa appeared in the blood corpuscles with the same characteristics as when the infection occurred through the medium of ticks. There could no longer be any doubt that the blood of cattle from the infected district contained the contagion of Texas fever.

It was now important to decide how long Southern cattle carried this contagion in their blood after leaving the infected district. Again, it was necessary to resort to inoculation, as the microscope was powerless to decide. The first experiments had been made with

the blood of cattle immediately after they had been brought from the South. In the next experiment blood was used from an animal that had been away from the infected district seventy-four days. This also produced disease. In succeeding years experiments were made by inoculating with the blood of cattle that had been under observation, with no chance for reinfection, for one year, two years, three years, four years, five years, six years, and seven years, and in every case the disease was produced. It was concluded, therefore, that this contagion once introduced into the blood of cattle remained there in an active condition throughout the animal's life.

THE PRINCIPAL FEATURES OF TEXAS FEVER.

We were now in a position to understand and explain the principal features of this disease, that is, it was plain that cattle in the infected district carried in their blood the contagion of Texas fever; that this contagion was in reality a protozoan organism called the *Pyrosoma bigeminum*, analogous to the parasite of human malaria; that this parasite was transferred to susceptible cattle outside of the infected district by the Southern cattle tick *Boophilus bovis*; that Southern cattle, although carrying the contagion, were harmless unless infested by this particular tick; that the Southern cattle carried this contagion in their blood for years after leaving the infected district, and would again be dangerous to other cattle if by any chance they were reinfested with the proper species of ticks. A study of the biology of the tick showed that the time required for the eggs to hatch depends upon the atmospheric temperature, and that all the mysteries of the propagation and incubation of the disease depended upon the hatching of these eggs.

THE PROGRESS MADE IN THE CONTROL OF TEXAS FEVER.

The above is a remarkable chapter in the progress of medical science, and has already led to extensive studies of the part played by insects in the propagation of human diseases, and particularly the malarial fevers. That it has opened up a new field of medical research is unquestionable. What has it accomplished toward the control and eradication of Texas fever? In the first place, it has given us a ready method of identifying infectious cattle found in the channels of commerce. Previous to these investigations it was often impossible to tell whether a given carload of cattle unloaded at any stock yards was from the infected or noninfected district. The point from which it was billed was no criterion, since it was common to rebill cars, often for the express purpose of deceiving the inspectors. These great centers of cattle traffic were, consequently, continually infected. To-day, if cattle are infested with the *Boophilus bovis* ticks, they are sent without question to the quarantine yards.

Another line in which progress has been made is in lessening the

area of the infected district. Whole counties have been placed above the cattle quarantine line, because the ticks have been destroyed in those counties and the danger of contagion removed. In many other counties the citizens have taken up the task of tick killing and are making rapid progress in freeing their districts from this pest. The infected district, instead of advancing and enlarging in area, as before these investigations, is now diminishing. This work is of immense advantage to the people of the districts involved.

Great success has also been achieved in immunizing cattle taken to the infected district for improving the stock. In the past the greater part of the cattle taken to the infected district died of Texas fever. These losses were 80, 90, and even 95 per cent of the animals introduced. Still, it was so important to grade up the cattle in the vast herds of the South and Southwest that the people of those sections persisted and accomplished much even under such discouraging circumstances. In pursuing the inoculation experiments it was learned that young animals, particularly calves, were much less severely affected than old ones, even with the same dose of virulent blood; also, that as cold weather approached a milder form of disease was produced in the same class of animals. Putting these two facts together, it was decided to immunize some young cattle and test their resistance in the infected district. This was successfully accomplished, and proved that young stock inoculated in the late fall or early winter with virulent blood contracted a mild form of disease, from which the experimental animals recovered, and that these animals sent to the infected district the following spring were but slightly affected with the disease, although untreated animals sent with them either died or were very severely affected and barely survived.

This method of immunizing has now been adopted in practice and is proving very satisfactory. Instead of a loss of 90 per cent among breeding stock taken South, it has been shown that more than 90 per cent can be saved. This means rapid improvement of Southern herds and a vast increase in the value of the animals produced.

There is one other problem under experimentation, which, if it can be solved, will remove the last terrors of Texas fever. That problem is the rapid and inexpensive destruction of the ticks upon cattle from the infected district. Such cattle are now dangerous because of these ticks. They are not allowed to go North, except for slaughter, during ten months of the year. They are always regarded with suspicion, quarantined, and sold as quarantine cattle at a reduced price. This is a constant hardship to the people of a great section of the country; but destroy all the ticks and the cattle are harmless and can go anywhere, for any purpose, at any season of the year. The plan of destroying the ticks is to drive the cattle through a vat containing some liquid that will be fatal to the ticks without injuring the cattle. While it has proved a difficult task to find a liquid that will answer these con-

ditions, there are some which are so nearly satisfactory as to inspire hopes that success in this line will in the near future be achieved.

RABIES.

The disease called rabies, or more popularly hydrophobia, has been known and described since the earliest historical times. No disease has been enshrouded with more mystery; none has been regarded with greater dread and horror, nor has any been more fatal to the affected individuals or accompanied in man with more evident signs of intense suffering and insupportable distress. Notwithstanding these facts there is probably no disease about which there has been more controversy, and none the very existence of which has been more persistently questioned and denied.

Since Aristotle in the fourth century before our era described the disease and alleged that dogs with this malady infect every creature which they bite *except mankind*, there have apparently been persons who have expressed doubts as to whether the hydrophobia of man was a specific disease or a nervous affection brought on by worry, anxiety, and fear. It was shown long ago that there might be a false rabies, a disease not necessarily fatal, yet having symptoms closely simulating those of the genuine disease. This nonspecific disease has been sometimes called lyssophobia, or fear of rabies, being in some cases merely a nervous, hysterical condition or what has been termed a mimetic disease.

It was only a step from the recognition of the existence of a disease not due to contagion, but having the symptoms of rabies, to the formulation of the doctrine that true rabies is a myth, with no other foundation than ignorance and hasty generalization from imperfectly observed facts. And yet it is plainly seen that the second conclusion does not necessarily follow from the first, since there is nothing inconsistent in the admission of both a specific and a nonspecific disease of the nervous system in which the symptoms are substantially the same. We have a striking example of the existence of a contagious and non-contagious disease with the same symptoms in cattle, which have both a simple inflammation of the lungs and pleura and a specific inflammation of these organs known as contagious pleuropneumonia. In these two diseases the symptoms are practically identical. In the same manner it is conceivable that functional disturbance and different forms of irritants affecting like parts of the brain may produce very similar manifestation.

The little that was really known previous to the nineteenth century about rabies, beyond the mere observation of the disease following the bite of a rabid dog, contributed to the fabrication of grotesque beliefs and to the adoption of absurd and cruel forms of prevention and treatment. These erroneous views and practices have not been entirely eradicated, and some of them are still cited with the greatest

confidence by those who oppose measures for the control of the disease.

Homer is supposed to refer to rabies when he mentions the dog star, or Orion's dog, as exerting a malignant influence upon the health of mankind. This ancient belief has come down to our times, leading intelligent people to hold that it is principally during the dog days that rabies develops, and that outbreaks at other seasons must be due to an entirely different disease. Arguments such as this have been recently used in the District of Columbia to prove that a disease which was developed and propagated in winter could not be rabies. The scientific study of the disease and the statistical records show, however, that rabies is prevalent in winter as well as in summer, and that the influence of the dog star is not to be detected by any methods heretofore invented.

The following tabulated statement of some of the statistics compiled during the century makes it plain that the disease is by no means confined to any one season of the year:

Table showing cases of rabies in dogs by months.

Source.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bourrel ¹	36	31	26	32	32	42	32	30	35	41	24	32	306
Saint-Cyr ²	12	15	6	15	13	7	4	9	1	3	0	12	87
Högves ³	300	310	314	367	450	502	580	537	455	438	303	396	4,961
Leblanc ⁴	103	97	121	192	155	138	147	123	104	117	95	100	1,492
France: ⁵													
1885.....	89	155	153	184	181	129	157	147	133	110	105	149	1,692
1886.....	124	138	151	150	147	190	138	117	131	125	103	204	1,687
1887.....	131	151	189	202	225	172	192	154	136	131	150	140	1,973
1888.....	139	148	.....	181	216	278	185	177	150	.....	153	154	1,781
Total.....	943	1,045	960	1,323	1,419	1,467	1,435	1,294	1,145	965	933	1,137	14,066

¹ Fleming. Rabies and Hydrophobia, London, 1872, p. 96.

² Loc. cit., p. 97.

³ Högves. Lyssa, Wien, 1897, p. 25.

⁴ Leblanc. Statistique de la rage, Bul. de l'acad. de med., 1880, pp. 960-963.

⁵ Official statistics.

Bouley¹ compiled statistics showing 755 cases in December, January, and February; 857 in March, April, and May; 788 in June, July, and August, and 696 in September, October, and November. At the Alfort Veterinary School, for the years 1887, 1888, 1889, and 1890, the cases were as follows: January, February, and March, 130; April, May, and June, 60; July, August, and September, 50; October, November, and December, 74.

Fleming² says that Grattius Faliscus, a poet and contemporary of Ovid, who lived in the first century of our era, has described some diseases of dogs, and among them rabies. He knew the fable of the

¹ Dict. de Méd. de chir. et d'hyg. vet. Zundel, Paris, 1877, p. 348.

² Loc. cit., pp. 11-12.

worm in the dog's tongue as the cause of the malady, a myth rendered popular by Pliny, and which is commonly believed by ignorant people even in our own time. Pliny wrote:

There is a small worm in a dog's tongue known as "lytta" (rage or madness) of the Greeks. If this is removed from the animal while a pup it will never become mad or lose its appetite. This worm, after being carried thrice around a fire, is given to persons who have been bitten by a mad dog to prevent their becoming mad. This madness, too, is prevented by eating a cock's brains, but the virtue of these brains lasts for one year only and no more. * * * The flesh also of a mad dog is sometimes salted and taken with the food as a remedy for this disease. In addition to this, young puppies of the same sex as the dog that has inflicted the injury are drowned in water and the person who has been bitten eats the liver raw.

The removal of the so-called worm from the dog's tongue has been practiced from the days of Pliny (first century A. D.) to our own time and is popularly known as "worming." For absurdity as a prophylactic measure and cruelty it is on a par with the operation referred to by Columella as practiced by the shepherds of his time and which also remained a classical method of treatment so long that persons who were still using it in Great Britain were not many years ago convicted of cruelty to animals. Columella says it was believed among the shepherds that if on the fortieth day after the birth of a pup the last bone of the tail is bitten off the sinew will follow with it; after which the tail will not grow (*foedum incrementum*—foul increase) and, as many shepherds say, this operation secures the dog from the disease.¹

This gross ignorance and superstition, of which many more examples might be given, was met early in the century by the scientific investigators, who attempted by systematic experiments to learn the real facts concerning the origin, cause, and nature of the disease. Zinke, in 1804, inoculated a dog, a rabbit, and a cock with saliva from a rabid dog, taking the saliva with a brush from the animal soon after its death and spreading it over superficial wounds of the inoculated animals. The dog showed some symptoms on the eighth day and was rabid on the ninth day. The rabbit was rabid on the eleventh and the cock on the fourteenth day.²

This experiment proved (1) the virulence of the saliva of rabid dogs; (2) that the disease might be artificially inoculated; (3) that the disease might be communicated by inoculation to the dog, the rabbit, and the fowl, and (4) it disproved the old doctrine that the contagion disappeared at the instant of the animal's death (*morte la bête, mort le venin*).

Count Salm-Reiferscheid, in 1813, recorded experiments in which several dogs were inoculated, part with fluid and part with dried saliva from a rabid dog. These were affected with rabies in eight to

¹ Fleming, loc. cit., p. 16.

² Högyes; Lyssa, Wien, 1897, p. 32.

ten days.¹ This experiment proved that the saliva remained virulent a considerable time after the dog's death, and that it would even withstand a certain amount of drying.

These two series of experiments give us the evidence of the existence of a specific, communicable disease of the dog, which is transmitted by inoculation with the saliva. There was still a question as to whether cattle and sheep, animals which do not naturally defend themselves or combat others by biting, developed virulent saliva when they contracted the disease. To determine this, Berndt, in 1822, inoculated four wethers with saliva from the mouth of an ox which had died of rabies. All of these sheep contracted rabies, the period between inoculation and the appearance of the first symptoms being 22, 25, 26, and 31 days.²

In 1841-42 Professor Rey, of the Veterinary School of Lyons, France, inoculated from sheep to sheep, using the saliva and inserting by lancet punctures. Of seven animals inoculated in this manner six contracted the disease.³

Renault reported that from 1836 to 1860 he had inoculated or caused to be bitten 131 dogs in his experiments, and that 68 of these afterwards became affected with rabies. The period of incubation varied with these animals from 10 days to 118 days and with about 18 per cent it was 60 days or longer.⁴ This report gave much information as to the proportion of inoculated dogs which contracted the disease and as to the period which may be expected to elapse between the inoculation and the appearance of the symptoms.

There were many persons, including physicians, who at the beginning of the century doubted the transmission of rabies to man. The medical doctrines at that time were unfavorable to the idea of contagion and the inclination was to look upon rabies as a simple irritation of the central nervous system. These views were exploded by Magendie, who inoculated a dog under the skin of the frontal region with the saliva of a young man under treatment for rabies. This dog became rabid in about a month, and was allowed to bite two other dogs, which in turn became rabid after 40 days.⁵

Earle, Hertwig, Renault, and others made similar inoculations from affected persons to rabbits, conveying the disease. It was also shown that children, so young that they could not cause the disease by worry and dread, were affected by the bites of rabid dogs in the same manner as adults.⁶

¹Högyes, loc. cit., p. 32.

²Journal der practischen Heilkunde, C. W. Hufeland, 1824, Nov., pp. 50-61.

³Rey. Expériences sur la Rage. Journal de Médecine de Lyon, Dec., 1842, p. 461.

⁴Comptes Rendus Acad. des Sciences, 1863, p. 72.

⁵F. Magendie. Journal de Physiologie Expérimentale, 1821, p. 43.

⁶Tardieu. Discussion sur la rage. Bul. de l'Acad. de Méd., 1863, p. 1152.

It was, consequently, demonstrated that rabies is communicable to man as well as to animals and that the saliva becomes virulent with man as it does with the lower animals.

The diagnosis of rabies has been called in question in all ages and there have always been persons who have asked, How do you know that this particular animal or that this individual person is affected with rabies and not with some other disease of the nervous system? The answer of the investigator is, If inoculations from this animal or this person transmit the disease to the inoculated animals, then it is certain that the individual from which the inoculation was made was affected with the disease. That is to say, rabies can not be produced with the saliva of animals or men affected with noncontagious diseases, nor is there any other known contagious disease with similar characteristics which may be confounded with rabies. The inoculation or biological test is therefore an accurate and reliable test and should be used in all cases of doubt. It is identical in principle with the biological tests of glanders, pleuro-pneumonia, foot-and-mouth disease, rinderpest, variola, and other contagious diseases of animals which have long been used and relied upon in case other methods of diagnosis fail.

The value of rabbits for making the biological test of rabies was pointed out by Galtier in 1879 and by Pasteur a few years later. The obstacles to this test in practice were (1) that the saliva generally contained various kinds of bacteria and might cause the death of the rabbits from septic infection, and (2) that the period of incubation might be long and uncertain when cutaneous or subcutaneous inoculations were made. The investigations of Pasteur (1881) showed the constant virulence of the brain and medulla, and that these organs, being protected from saprophytic germs, furnished a pure virus which might be used for biological tests. He also showed that the inoculations might be made upon the surface of the brain, in which case the disease was certainly transmitted and the period of incubation was reduced to a minimum.

Of late years the methods of Pasteur have been widely adopted. There are still skeptics, however, who object to this test on the ground that it is the irritation to the brain, caused by the inoculation, that produces the disease, and that there is no proof of contagion when the rabbits die of supposed rabies. These people forget, however, that it is always possible in case of doubt to make the inoculation in the skin or muscles, or even to use larger animals, such as horses, cattle, sheep, or dogs. Rabbits are used only because they are cheap and convenient. Brain inoculations are made because they are more certain in results and the disease appears sooner. The Pasteur method has been sufficiently confirmed by other methods and its reliability clearly demonstrated.

As a final step, Pasteur discovered that the virus of rabies might be

attenuated and used as a vaccine for preventing the development of the disease in bitten persons. This treatment, which is one of the greatest achievements of modern science, has been administered to thousands of persons who have been bitten, and the death rate among persons so treated has been reduced to less than 1 per cent. The objection has been raised to these statistics that they include many persons who were bitten by dogs that were not proved to be rabid, and that consequently the death rate is misleading. It may be said in answer to this objection that the statistics also include a large number of persons bitten by dogs that were proved to be rabid, either by inoculation experiments or by the fact that they had bitten animals which afterwards contracted the disease, and that the death rate among this class of persons is equally low.

This prophylactic treatment is the culmination of the experimental studies of the disease, and while it has been modified somewhat and perfected, it is not likely to be superseded. There is still no curative treatment for subjects in whom the disease has developed, and there is little prospect of a successful treatment being discovered. The disease is unquestionably due to a living organism, a parasite of some kind, which finds its way to the brain and multiplies in the interior of that organ, causing irritation and disease. To reach this parasite in the brain and destroy it without fatal injury to the brain substance appears, from our present knowledge of the subject, to be impossible. What we should aim to do, and what is entirely within the bounds of possibility, is to eradicate the disease in carnivorous animals, and thus save mankind from the horrible sufferings occasioned by it.

One of the conclusions reached from the investigations of the century and by no means the least important is that rabies develops only by inoculation from an animal already diseased. During the first sixty years of the century nearly every one believed that the disease originated spontaneously as the result of certain unfavorable conditions to which dogs and perhaps cats were subjected. It has, however, become clearer and clearer as knowledge increased that this could not be the case. Experiments to produce the disease by subjecting healthy dogs to the conditions supposed to be sufficient have all failed. It has also been shown that Australia was kept free from the disease by the maintenance of strict quarantine, that it was stamped out of Norway and Sweden, that it was practically eradicated from Berlin, and that Great Britain has been nearly or quite freed from it by sanitary measures. These facts demonstrate that rabies like other strictly contagious diseases does not originate spontaneously, but is dependent for its existence upon contagion from preexisting cases. It follows from this that any country may do what some have done—that is, may eradicate the disease, and that once eradicated it will not reappear until the contagion is imported from some other country where the disease has been allowed to continue. Just as we eradicated contagious

pleuro-pneumonia a decade ago and have since remained free from it, so we might eradicate rabies and relieve our country from the loss, the anxiety, the suffering, and the deaths which it causes.

With rabies, as with other diseases which we have studied in this article, the history of the development of our knowledge shows how valuable, how indispensable, has been the experimental method. Applied at the beginning of the century, when for more than two thousand years the observation of man had failed to dispel the obscurity, the mystery, and the ignorance with which the disease was surrounded, this method of investigation has gradually lifted the veil and let in the light. To-day there is no greater mystery about rabies than there is about other contagious diseases. While the organism causing the disease has not been discovered and identified, the same is true of several other contagious diseases, and this is no longer an obstacle to the formulation of sanitary measures. The important characteristics of the disease have been established and our knowledge rests upon a firm and indestructible foundation.

Confining our argument to the facts which have already been demonstrated, have we not abundant justification for the experimental method? With a disease so obscure and complex, depending upon two different parasites for its dissemination, one of these so small as to tax the highest powers of the microscope, it was impossible for observation, unaided by experimentation, to solve the mysteries and elucidate it. But the experimental method was invoked, and, as in many other fields of biology, has brought order out of chaos, giving an intelligent comprehension and control of phenomena, where before were only ignorance and helplessness.

ADMINISTRATIVE WORK OF THE FEDERAL GOVERNMENT IN RELATION TO THE ANIMAL INDUSTRY.¹

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PRELIMINARY REMARKS.

Diseases of domestic animals have been the subject of many articles and letters which have appeared in the Annual Reports for the Department of Agriculture since its organization, and even previous to that time in the agricultural part of the Patent Office Reports. The first investigations were undertaken by Department authority in 1868, at a time when Texas fever and contagious pleuro-pneumonia were creating considerable alarm among the cattle raisers of the country. In 1882 and 1883 the investigation of Texas fever was taken up with a view to ascertaining its causes and methods of prevention and establishing definitely the areas infected by it. However, no administrative work relative to the animal industry of the country was undertaken by the Federal Government previous to the establishment of the Bureau of Animal Industry in the Department of Agriculture in 1884, except the limited amount done by the Treasury Department at the quarantine stations at the ports of import. One of the purposes of the establishment of the Bureau was to inaugurate and supervise the Federal administrative work relative to contagious diseases of animals, and the history of the work in the United States forms a large portion of the history of the Bureau.

The work of the State governments relative to animal diseases can not be given within the limits of this paper, but it is well to say that, even before the Federal Government took up the work, several States had enacted laws for the control of contagious diseases of animals. Such enactments, while they might not have been inefficient, were found to be inadequate, since the regulation of the movement of animals from State to State could only be accomplished by the Federal Government; hence, the necessity was apparent that the latter should take up the great work and cooperate with the States.

AUTHORITY CONFERRED AND SCOPE OF THE WORK.

The authority possessed by the Department of Agriculture for enforcing measures with reference to contagious diseases of domestic

¹ This article also appears in the Yearbook of the United States Department of Agriculture for 1899.

animals is conferred by "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," which was approved by the President on May 29, 1884. The power thus conferred is not in all cases sufficient to effect the eradication of a disease, for the reason that the Federal Government can not enforce measures within a State without the legislative consent of that State, unless the animals affected are subjects of or endanger interstate commerce. Its work, therefore, without the cooperation of the States affected, is limited to interstate traffic, and quarantine lines are thus made to follow State lines. It has always been a matter of gratification, however, that wherever the Bureau of Animal Industry has undertaken to suppress and eradicate a contagious disease the authorities of the affected States have readily lent their assistance. A State, on the other hand, can do nothing more than guard its own territory; and, while all of the States have laws for the control of live stock traffic with a view to the prevention or suppression of disease, it could hardly be expected that they would under all circumstances cooperate with each other effectually. The work of the Federal Government is therefore necessary to the State, and the State laws are necessary to the Federal Government, if success in eradicating disease from the country is to be assured; the Federal and State powers are not only supplementary, but interdependent.

CONTAGIOUS PLEURO-PNEUMONIA WORK.

The success of the Bureau of Animal Industry in eradicating contagious pleuro-pneumonia from this country was a triumph that will never be forgotten by the cattle owners of the United States. This disease had become established in several States east of the Allegheny Mountains, and later broke out in Ohio, Illinois, and Kentucky, all great cattle-growing States of the Mississippi Valley. From these States it threatened to spread over the great cattle districts of the West and completely to ruin the industry. The country was thoroughly alarmed, and Congress was prevailed upon to enlarge the powers of the Bureau of Animal Industry to deal with contagious diseases of domestic animals, contagious pleuro-pneumonia being especially mentioned.

A thorough study was immediately begun of the history of the disease in this country and abroad and of the means and methods employed elsewhere for its eradication. Dr. D. E. Salmon, who became the chief of this new Bureau, speaking of this disease in 1883, had said "that the only object kept in view should be its complete extinction by the most summary measures at our command," and further: "We can recommend no temporizing measures with regard to this affection. The only ones applicable are quarantine, restriction of

movement of cattle, slaughter of affected animals, and disinfection." The veterinary profession the world over was agreed as to the efficacy of these measures alone, and the Bureau desired to adopt them at once in entering upon the pleuro-pneumonia work. In fact, rules and regulations providing for the destruction by Bureau inspectors of affected animals and the certification of the assessed value of such animals to the Commissioner of Agriculture, who, upon approval, would order payment for the same, were issued by the Commissioner of Agriculture on April 22, 1885; but about the same time the Attorney-General of the United States rendered an opinion, based upon the organic act creating the Bureau, that there are "no provisions for purchasing the diseased and exposed animals," thus rendering null and void the rules and regulations of the Commissioner. However, in the appropriation act for the fiscal year of 1887 the Commissioner was authorized to expend the appropriation "in such manner as he may think best to prevent the spread of pleuro-pneumonia * * * and to expend any part of this sum in the purchase and destruction of diseased animals wherever in his judgment it is essential to prevent the spread of pleuro-pneumonia from one State to another." From that time forward the work was pushed vigorously and successfully.

In accordance with the organic act creating the Bureau and also with the appropriation act just quoted, rules and regulations, dated August 12, 1886, were formulated for prosecuting the work. Provision was made for the acceptance of these rules and regulations by the governors of the affected States, which in most instances was promptly done. In the matter of inspection, the Bureau was to furnish the necessary inspectors, who were to receive from the proper State officers the authority to make inspections of cattle under the laws of the State, to receive such protection and assistance as would be given to State officers engaged in similar work, and be permitted to examine quarantined herds wherever so directed by the Commissioner of Agriculture or the chief of the Bureau of Animal Industry. Reports upon inspections were to be made to the Bureau of Animal Industry and to the proper State authorities. When contagious pleuro-pneumonia was discovered in a herd, the owner or person in charge was at once to notify the inspector, who was to put in force the quarantine regulations of the State in which the herd was located. Every animal of an infected herd was distinctively marked with a lock and chain, which were furnished by the Bureau, but which became the property of the State when placed upon an animal, in order that anyone tampering with them would become amenable to the laws of the State. Quarantine restrictions were for a period of not less than ninety days, and were not to be removed without the consent of the Bureau. All affected and exposed animals were to be slaughtered as soon after discovery as possible, were to be appraised according to the provisions of the State law, and the representatives of the Bureau

notified of the appraisement. The Department of Agriculture was to pay to the owner such portion of the appraised value as was provided by the laws of the State for cattle condemned and slaughtered by State authority. All necessary disinfection was to be conducted by the Bureau. The Bureau did not recommend inoculation for the disease, but retained supervision over the herds which were inoculated under State authority.

These regulations were modified from time to time as necessity arose. On April 15, 1887, the chief of the Bureau was authorized to inspect stock yards, cars, boats, and other vehicles of transportation lines, and to make the necessary regulations for their quarantine and disinfection. A few weeks later a notice was sent to the managers of transportation lines, calling their attention to the existence of contagious pleuro-pneumonia among cattle in Illinois, Maryland, and New York, requesting their cooperation in preventing the spread of the disease by means of disinfection and by declining to receive cattle for shipment which were not known to be free from infection. Still later this notice was modified so as to apply to all States affected.

These measures soon began to give good results, enabling the chief of the Bureau of Animal Industry to make the following statement in his report for 1888:

The prompt eradication of pleuro-pneumonia from Chicago and vicinity is worthy of more than a simple narration of the fact. It may well be considered one of the most important results ever accomplished by the Department of Agriculture. History gives few if any cases where the dairies of a city of the size of Chicago have once been infected with pleuro-pneumonia and where the disease has been eradicated without years of constant work and the expenditure of vast sums of money. Paris was infected more than one hundred years ago, and in spite of the large number of veterinarians in that district, and of the stringent laws and regulations promulgated for its suppression, the disease still exists, and the ravages continue from year to year apparently undiminished.

At the same time the disease was eradicated from all affected districts in Maryland outside of the city of Baltimore, and in Virginia it was completely suppressed. In the other affected States the work had been most satisfactory. In 1889 the progress of the work was notable, being hampered only by lack of full authority on the part of the Bureau properly to enforce its regulations. The plague had not reappeared west of the Allegheny Mountains and no extensions occurred in the Eastern States. Cattle owners and shippers outside of the infected districts had gained such confidence in the work that the presence of the disease in this country no longer interfered with the traffic to any appreciable extent. In 1890 the chief of the Bureau reported as follows:

The year has passed without any discovery of contagious pleuro-pneumonia outside of the districts which were recognized in the last report as infected. The regulations of the Department have been enforced without difficulty, and the progress of the work for the eradication of this plague has been continuous and rapid.

* * * * *

The efficiency of the regulations and of the methods employed under them is demonstrated by the fact that for two years there has not been a case of the disease outside of the very restricted areas on the Atlantic seaboard which have from the first been recognized as infected. These regulations are still in force, and with the almost complete eradication of the contagion the danger of any infection extending to other sections has practically disappeared.

In 1891 the disease had disappeared from all of the States that had been infected except New Jersey, where it was restricted to a very small area, enabling the Bureau to publish the statement that "the United States is now practically free from contagious pleuro-pneumonia." On March 25, 1892, the last case of the disease disappeared from the United States, and six months later the following proclamation was issued:

PROCLAMATION—ERADICATION OF PLEURO-PNEUMONIA.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY.

To all whom it may concern:

Notice is hereby given that the quarantines heretofore existing in the counties of Kings and Queens, State of New York, and the counties of Essex and Hudson, State of New Jersey, for the suppression of contagious pleuro-pneumonia among cattle, are this day removed.

The removal of the aforesaid quarantines completes the dissolving of all quarantines established by this Department in the several sections of the United States for the suppression of the above-named disease.

No case of this disease has occurred in the State of Illinois since December 29, 1887, a period of more than four years and eight months.

No case has occurred in the State of Pennsylvania since September 29, 1888, a period of four years, within a few days.

No case has occurred in the State of Maryland since September 18, 1889, a period of three years.

No case has occurred in the State of New York since April 30, 1891, a period of more than one year and four months.

No case has occurred in the State of New Jersey since March 25, 1892, a period of six months, and no case has occurred in any other portion of the United States within the past five years.

I do therefore hereby officially declare that the United States is free from the disease known as contagious pleuro-pneumonia.

J. M. RUSK, *Secretary.*

Done at the city of Washington, D. C., this 26th day of September, A. D. 1892.

It may be that those countries which are still afflicted with the plague of contagious pleuro-pneumonia are in position better to appreciate the importance of the work done in this country than we are ourselves. If the Bureau of Animal Industry, by eradicating this disease from the country, were to be given credit for the value of all losses which would have resulted from a continuance of the disease, as well as for the money which might have been expended ineffectually by the State authorities toward suppressing it, who can estimate what it would be?

In a summary of the work of the Bureau, published in 1897, the

chief wrote as follows regarding the eradication of contagious pleuro-pneumonia:

It is almost impossible at this time to give an idea of the danger with which the cattle industry was menaced by the spread of that fatal and treacherous disease to a point so far in the interior as Chicago or of the difficulties under our form of Government of promptly and effectually meeting the emergency. Fortunately, although the cattle owners in the affected districts were not friendly, the State authorities cooperated in every case and supplied the power which was lacking in federal legislation, and although there were many who questioned the existence of the European lung plague in this country, who did not believe in the success of the measures that were adopted, who were positive that the disease could not be eradicated, or who were certain that untold millions of money would be squandered before the end was reached, the result was accomplished with an expenditure of less than five years of time and of \$1,500,000—a sum which is less than 5 per cent of the value of the beef exported in 1892.

When we consider that the Governments of Great Britain, France, and Germany all undertook the work of eradicating pleuro-pneumonia long before the establishment of our Bureau of Animal Industry, and that none of them have yet succeeded in freeing their territory from the plague, we can appreciate the fact that the completion of our task in a comparatively short time was a notable achievement.

In order to make this review of the pleuro-pneumonia work complete and satisfactory, the following tables, taken from the report of the Bureau for 1892, are given:

Work done in the eradication of contagious pleuro-pneumonia, by years.

ILLINOIS.

Character of work.	September 1, 1886, to December 3, 1887.	1888.	Total.
Herds inspected.....	7,411	140	7,551
Cattle inspected.....	24,059	285	24,344
Post-mortem examinations.....	7,267	1,712	8,979
Number diseased on post-mortem.....	350	4	354
Premises disinfected.....	677	1	678
Diseased cattle purchased.....	172	4	176
Exposed cattle purchased.....	870	129	999

MARYLAND.

Character of work.	1887.	1888.	1889.	1890.	Total.
Herds inspected.....	5,704	9,809	10,904	4,210	30,627
Cattle inspected.....	57,868	60,312	79,606	108,376	306,162
Cattle tagged.....		17,749	10,534	5,403	33,746
Post-mortem examinations.....	2,788	5,820	11,491	12,949	33,048
Number diseased on post-mortem.....	1,137	507	76		1,720
Premises disinfected.....	145	145	35	1	326
Diseased cattle purchased.....	a 1,442	459	73		1,974
Exposed cattle purchased.....	a 1,564	1,036	310	20	2,930

a Includes all purchases of cattle from July 1, 1886, to December 31, 1886.

Work done in the eradication of pleuro-pneumonia, by years—Continued.

NEW YORK.

Character of work.	1887.	1888.	1889.	1890.	1891.	a 1892.	Total.
Herds inspected.....	1,511	12,333	15,861	19,569	13,381	2,537	65,192
Cattle inspected.....	25,122	99,726	149,306	150,474	136,111	49,925	610,754
Cattle tagged.....		100,370	33,135	33,752	30,294	13,559	211,109
Post-mortem examinations.....	1,347	15,538	15,375	18,338	26,953	18,871	96,422
Number diseased on post-mortem	447	2,287	1,012	544	31	.....	4,321
Premises disinfected.....		1,339	339	434	49	.....	2,161
Diseased cattle purchased.....	206	1,576	1,053	427	25	.....	3,247
Exposed cattle purchased.....	736	3,196	2,819	1,984	284	.....	9,019

NEW JERSEY.

Character of work.	1887.	1888.	1889.	1890.	1891.	a 1892.	Total.
Herds inspected.....	1,428	8,018	8,455	8,492	8,124	16,813	51,330
Cattle inspected.....	16,461	72,095	76,001	60,659	68,262	128,017	421,435
Cattle tagged.....		13,318	11,672	8,817	12,818	22,153	68,778
Post-mortem examinations.....	248	6,846	14,242	9,419	4,417	5,562	40,734
Number diseased on post-mortem	113	514	189	43	63	32	954
Premises disinfected.....		275	208	104	57	196	840
Diseased cattle purchased.....	94	502	116	44	48	40	844
Exposed cattle purchased.....	117	945	714	242	227	222	2,467

PENNSYLVANIA.

Character of work.	1888.	1889.	1890.	1891.	a 1892.	Total.
Herds inspected.....	5,291	1,311	1,915	1,006	2,638	12,251
Cattle inspected.....	72,565	24,603	24,388	55,533	66,487	242,976
Cattle tagged.....	51,830	1,513	.....	.....	.....	53,343
Post-mortem examinations.....	13,157	13,412	15,008	55,290	80,384	177,221
Number diseased on post-mortem.....	72	17	.....	.....	.....	89
Premises disinfected.....	117	6	.....	.....	.....	123
Diseased cattle purchased.....	63	.....	.....	.....	.....	63
Exposed cattle purchased.....	131	11	.....	.....	.....	142

SUMMARY.

Character of work.	Illinois.	Maryland.	New York.	New Jersey.	Pennsylvania.	Total.
Total herds inspected.....	7,551	30,627	65,192	51,330	12,251	166,951
Total cattle inspected.....	24,344	300,152	610,754	421,495	242,976	1,600,721
Total cattle tagged.....	.....	33,746	211,109	68,778	53,333	366,966
Total post-mortem examinations.....	8,979	33,048	96,422	40,734	177,221	356,404
Total diseased on post-mortem.....	354	1,720	4,321	954	89	7,438
Total premises disinfected.....	678	326	2,161	840	123	4,128
Total diseased cattle purchased.....	176	1,974	3,347	844	63	6,304
Total exposed cattle purchased.....	999	2,930	9,019	2,467	142	c 15,557

a The figures for 1892 are brought down to September 26, the date on which the quarantine was removed.

b Not including 45 diseased animals purchased in Virginia and District of Columbia.

c Not including 57 exposed animals purchased in Virginia and District of Columbia.

Expenditures in the eradication of contagious pleuro-pneumonia from July 1, 1886, to September 1, 1892.

State.	Salaries.	Traveling.	Miscellaneous.	Affected cattle.	Exposed cattle.	Total.	Number of animals affected.	Number of animals exposed.
New York	\$385,672.70	\$58,013.29	\$28,897.52	\$87,241.69	\$188,669.80	\$758,495.00	3,347	9,019
New Jersey	185,533.92	44,018.03	12,956.79	20,477.50	60,967.70	323,953.94	844	2,467
Pennsylvania	40,201.36	4,462.44	2,614.66	1,243.50	3,357.50	51,879.44	63	142
Maryland	124,948.22	33,705.74	5,667.42	48,363.41	76,115.85	288,800.64	1,974	2,930
Illinois	52,170.31	3,819.29	4,126.61	3,200.80	16,561.64	79,938.65	176	909
Vermont, ¹ Massachusetts, ¹ Virginia, and District of Columbia	3,342.28	1,177.72	19.55	739.00	754.50	6,033.05	45	57
Total	791,868.79	145,196.51	54,282.55	161,325.90	356,426.99	1,500,100.72	6,449	15,614

¹ Investigating reported outbreaks.TEXAS FEVER WORK.¹

The direct losses to the cattle industry of the country from Texas fever at the time when the Bureau of Animal Industry was organized were much heavier than the losses from pleuro-pneumonia. Texas fever had been known under different names for many years, and had become thoroughly disseminated and established throughout the Southern portion of the United States. Although the true nature of the disease was not known, investigations had developed several important facts, namely, that Southern cattle, when taken to the North, though in the best of health, would carry with them the contagion; that Northern cattle, when taken to the South, would contract the disease; that there was, therefore, an infected and a noninfected area, between which it was necessary to draw a definite line; and that "even a fence was sufficient to arrest the disease."

If the cattle raisers of the noninfected region were to be protected from Texas fever, and if those of the infected area were to be permitted to ship their stock out of it, it was necessary that measures should be first adopted to control the transportation. Such measures were alike important in the South, where animals were imported from the North for the purpose of grading up the herds, and in the North, where Southern cattle were to find feed for fattening and a market. The noninfected area of the country was rapidly increasing its production of corn, and needed the feeders from the infected area to consume it.

When the Bureau of Animal Industry was established, it was recognized as one of its most important duties that the Texas fever

¹ Synonyms: Southern fever, splenetic fever, splenic fever, Spanish fever, acclimation fever, acclimatization fever, tick fever.

district must be accurately outlined, and that there must be laws absolutely preventing the driving of cattle from the infected to the noninfected sections, except during certain winter months. Previous to this, in 1883, the chief of the Bureau and his assistants had established the northern line of this district through Virginia. In 1884 the Bureau extended the line westward to the Mississippi River, and in the following year it reached the Rio Grande in Texas. Later it became necessary to include a part of California.

REGULATIONS REGARDING TEXAS FEVER.

Regulations were issued by Secretary Rusk in 1889, addressed to the managers and agents of railroad and transportation companies in the United States, directing their attention to the area infected with Texas fever and to the quarantine line thereby established. These regulations have been modified from time to time as necessities have arisen; and in order to give a satisfactory understanding of all the details of the work the regulations promulgated for the year 1899 are given below in their entirety. The quarantine line mentioned has since been amended by special orders, excluding on account of local cooperation the noninfected districts of some of the States, but in all essential points it is the same as originally defined:

To managers and agents of railroads and transportation companies of the United States, stockmen, and others:

In accordance with section 7 of the act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and of the act of Congress approved March 22, 1898, making appropriation for the Department of Agriculture for the fiscal year ending June 30, 1899, you are hereby notified that a contagious and infectious disease known as splenic, or Southern, fever exists among cattle in the following described area:

1. All that country lying south, or below, a line beginning at the northwest corner of the State of California; thence east, south, and southeasterly along the boundary line of said State of California to the southeastern corner of said State; thence southerly along the western boundary line of Arizona to the southwest corner of Arizona; thence along the southern boundary lines of Arizona and New Mexico to the southeastern corner of New Mexico; thence northerly along the eastern boundary of New Mexico to the southern line of the State of Colorado; thence along the southern boundary lines of Colorado and Kansas to the southeastern corner of Kansas; thence southerly along the western boundary line of Missouri to the southwestern corner of Missouri; thence easterly along the southern boundary line of Missouri to the western boundary line of Dunklin County; thence southerly along the said western boundary to the southwestern corner of Dunklin County; thence easterly along the southern boundary line of Missouri to the Mississippi River; thence northerly along the Mississippi River to the northern boundary line of Tennessee at the northwest corner of Lake County; thence easterly along said boundary line to the northeast corner of Henry County; thence in a northerly direction along the boundary of Tennessee to the northwest corner of Stewart County; thence in an easterly direction along the northern boundary of Tennessee to the southwestern corner of Virginia; thence northeasterly along

the western boundary line of Virginia to the northernmost point of Virginia; thence southerly along the eastern boundary line of Virginia to the northeast corner of Virginia where it joins the southeastern corner of Maryland, at the Atlantic Ocean.

2. Whenever any State or Territory located above or below said quarantine line, as above designated, shall duly establish a different quarantine line, and obtain the necessary legislation to enforce said last-mentioned line strictly and completely within the boundaries of said State or Territory, and said last above-mentioned line and the measures taken to enforce it are satisfactory to the Secretary of Agriculture, he may, by a special order, temporarily adopt said State or Territorial line.

Said adoption will apply only to that portion of said line specified, and may cease at any time the Secretary may deem it best for the interest involved, and in no instance shall said modification exist longer than the period specified in said special order; and at the expiration of such time said quarantine line shall revert without further order to the line first above described.

Whenever any State or Territory shall establish a quarantine line for above purposes, differently located from the above-described line, and shall obtain by legislation the necessary laws to enforce the same completely and strictly, and shall desire a modification of the Federal quarantine line to agree with such State or Territorial line, the proper authorities of such State or Territory shall forward to the Secretary of Agriculture a true map or description of such line and a copy of the laws for enforcement of same, duly authenticated and certified.

3. From the 1st day of January, 1899, no cattle are to be transported from said area south or below said Federal quarantine line above described to any portion of the United States above, north, east, or west of the above-described line, except as hereinafter provided.

4. Cattle from said area may be transported, by rail or boat, for immediate slaughter, and when so transported the following regulations must be observed:

(a) When any cattle in course of transportation from said area are unloaded above, north, east, or west of this line to be fed or watered, the places where said cattle are to be fed or watered shall be set apart, and no other cattle shall be admitted thereto.

(b) On unloading said cattle at their points of destination, pens, sufficiently isolated, shall be set apart to receive them, and no other cattle shall be admitted to said pens; and the regulations relating to the movement of cattle from said area, prescribed by the cattle sanitary officers of the State where unloaded, shall be carefully observed. The cars or boats that have carried said stock shall be cleansed and disinfected as soon as possible after unloading and before they are again used to transport, store, or shelter animals or merchandise.

(c) All cars carrying cattle from said area shall bear placards, to be affixed by the railroad company hauling the same, stating that said cars contain Southern cattle, and each of the waybills or bills of lading of said shipment by cars or boats shall have a note upon its face with a similar statement. Whenever any cattle have come from said area and shall be reshipped from any point at which they have been unloaded to other points of destination, the cars carrying said animals shall bear similar placards with like statements, and the waybills or bills of lading be so stamped. At whatever point these cattle are unloaded they must be placed in separate pens, to which no other cattle shall be admitted.

(d) No boat having on board cattle from said district shall receive on board cattle from outside of said district. Cattle from said district shall not be received on board when destined to points outside of said district where proper facilities have not been provided for transferring the said cattle from the landing to the stock yards and slaughterhouses without passing over public highways, unless permission for such passing is first obtained from the local authorities.

(e) The cars and boats used to transport such animals, the chutes, alleyways, and pens used during transportation, and at points of destination, shall be disinfected in the following manner:

Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime or saturating it with a 5 per cent solution of 100 per cent carbolic acid; or, if not disinfected, it may be stored where no cattle can come into contact with it during the period from February 1 to November 15 of each year.

Wash the cars and the feeding and watering troughs with water until clean.

Saturate the entire interior surface of the cars and the fencing, troughs, and chutes of the pens with a mixture made of $1\frac{1}{2}$ pounds of lime and one-quarter pound 100 per cent straw-colored carbolic acid to each gallon of water; or a solution made by dissolving 4 ounces of chloride of lime to each gallon of water may be used; or disinfect the cars with a jet of steam under a pressure of not less than 50 pounds to the square inch.

5. Cattle originating in said area may, after having been properly dipped, under the supervision of an inspector of this Department, be shipped without further restriction, excepting such as may be enforced by local authorities at point of destination: *Provided*, That application be first made to this Department, and permission granted to establish the dipping stations, and that after being dipped the cattle are certified by an inspector of the U. S. Bureau of Animal Industry, and that the cattle when dipped be shipped in clean cars, and not be driven through the infected district or unloaded therein except at such point as may be duly designated by an order issued by this Department.

6. From November 1 to December 31, inclusive, cattle from said area which are found free of infection upon inspection by officers of this Department may be moved north of the quarantine line without restriction other than may be enforced by local regulations at destination. If evidence of infection is found upon such inspection, the cattle must be dipped in accordance with the provisions of section 5 before being moved north of the quarantine line.

7. Cattle from the Republic of Mexico may be admitted into the United States, after inspection according to law, as follows:

(a) Cattle free from splenetic, or Texas, fever, and from contact therewith during the three months preceding such inspection, and which have been grazed in a locality free from infection of such fever, may be admitted into any part of the United States. If destined to points in the noninfected area, a special permit must be obtained from an inspector of the Bureau of Animal Industry, said permit being issued according to the regulations of said Bureau; the cattle for which said permit is issued must not be driven through the infected area, nor be unloaded in any part thereof except at such point as may be duly designated by an order issued by this Department; if shipped in infected cars, or unloaded in the infected area, except as above stated, they will be subject to the regulations concerning infectious cattle.

(b) Cattle found upon inspection to be infected or to have been exposed to infection during the preceding three months must be dipped at port of entry under supervision of an inspector of this Department prior to admittance to the United States; after dipping said cattle shall be subject to the conditions specified in the last preceding paragraph.

8. Notice is hereby given that cattle infested with the *Boophilus bovis*, or Southern cattle tick, disseminate the contagion of splenetic, or Southern, fever (Texas fever); therefore cattle originating outside of the district described by this order, or amendments thereof, and which are infested with the *Boophilus bovis* ticks shall be considered as infectious cattle and shall be subject to the rules and regulations governing the movement of Southern cattle.

9. Stock-yard companies receiving cattle infested with said ticks shall place such cattle in the pens set aside for the use of Southern cattle, and transportation

companies are required to clean and disinfect all cars and boats which have contained the same, according to the requirements of this Department.

10. Inspectors are instructed to see that disinfection is properly done, and to report instances of improper disinfection. It is expected that transportation and stock-yard companies will promptly put into operation the above methods.

All prior orders conflicting herewith are hereby revoked.

JAMES WILSON, *Secretary*.

It will be observed that section 5 of the regulations relates to the dipping of the cattle for the purpose of killing the tick, which is the carrier of the contagion. The Bureau has been experimenting along this line for several years, but, while progress has been made, a mixture has not yet been found which will kill the ticks and at the same time result in no injury to the animal. The end sought is so desirable that the Bureau will continue its work in the belief that a substance will be found which will prove entirely satisfactory.

The beneficial effect of such regulations was apparent from the first. Export cattle were protected from infection, and consequently losses from disease in transit were fewer each year. In 1891 such losses of export cattle from Texas fever amounted to 524 head, but fell to the number of 131 the following year, and since that there have been but two or three cases, and these at rare intervals. The result has been increased prices abroad and a great reduction of insurance on cargoes of cattle, as will be noted further on.

SHEEP SCAB AND HOG CHOLERA WORK.

In December, 1895, the regulations of the Bureau of Animal Industry were amended to the extent that "animals affected with hog cholera, tuberculosis, or sheep scab shall be considered animals affected with contagious or infectious diseases, * * * and shall not enter into interstate trade nor be brought into contact with other animals intended for such trade." Such animals are not permitted to enter any stock yards or other places where animals are handled for interstate trade, and when so found are condemned, tagged, and placed in quarantine. Stock-yard companies, transportation companies, and other parties receiving or handling such diseased animals are required to disinfect thoroughly such parts of their premises or property as contained such animals, subject to the approval of the inspectors of the Bureau. Animals so quarantined can not be removed except upon written permit of the inspector in charge. General instructions were given to the inspectors by the chief of the Bureau soon after the above-mentioned regulations were made, in which it was provided that sheep affected with scab might be liberated after being dipped one or more times and the inspectors convinced that the disease was cured.

Scab is one of the oldest diseases of sheep known to the veterinary profession, and while it is easily cured and methods for its eradication

are well known, it has been permitted to spread among flocks, to the great damage of the sheep industry of the country. The efforts which the Bureau had so far been able to make were not sufficient to control the spread of the disease. It became necessary in 1897 to issue an order to managers and agents of railroads, transportation companies, and stockmen, calling their attention to the fact that it was unlawful to transport diseased sheep from one State to another, and requesting their cooperation to prevent the further spread of the disease. Inspectors were instructed to see that all cars, boats, or other vehicles of transportation were properly cleaned and disinfected by their owners.

As the facilities of the Bureau have increased, the sheep traffic has received more attention and the restrictions have become more rigid. The question of dips had to receive consideration, as some of the dips on the market were not satisfactory, in that they did not kill the mite which is the cause of the scab. In consequence of this fact the following order was issued in July, 1899:

It is ordered, That from and after August 10, 1899, no sheep affected with scabies, and no sheep which have been in contact with others so affected, shall be allowed shipment from one State or Territory into another, or from any State into the District of Columbia, or from the District into any State, unless said sheep shall have first been dipped in a mixture approved by this Department.

The dips now approved are:

1. The tobacco-and-sulphur dip, made with sufficient extract of tobacco to give a mixture containing not less than five one-hundredths of 1 per cent of nicotine and 2 per cent flowers of sulphur.

2. The lime-and-sulphur dip, made with 8 pounds of unslaked lime and 24 pounds of flowers of sulphur to 100 gallons of water. The lime and sulphur should be boiled together for not less than two hours, and all sediment allowed to subside before the liquid is placed in the dipping vat.

The owner of the sheep is privileged to choose which one of the above-mentioned dips shall be used for his animals. The Department will instruct inspectors to enforce due care in dipping sheep, but it assumes no responsibility for loss or damage to such animals, and persons who wish to avoid any risks that may be incident to dipping at the stock yards should see that their sheep are free from disease before they are shipped to market.

In the matter of hog cholera and swine plague, the administrative work of the Bureau is under the same law as that for sheep scab. In addition to the methods of quarantine and disinfection, however, hogs are being given the serum treatment for these diseases. The serum for this work is prepared by the Bureau, and at present is administered for experimental purposes by the Bureau officials. During the last two years the work has been undertaken on a large scale in Page County, Iowa, by the legislative consent of that State, and the results have been very satisfactory. It is estimated that the saving in the treated herds has been from 75 to 80 per cent.

The "stamping-out" process, the same that was so successfully employed in the eradication of pleuro-pneumonia, was tried experimentally in eight townships of the same county in 1897, and the

results indicated that if the method were vigorously pursued for a few years the disease could thus be greatly reduced or possibly eradicated. A recapitulation of the work in 1897, giving also a comparison with the same period for 1896, shows wonderful success, especially if it be remembered that the disease in Page County was of long standing, and that therefore most farms were affected with the contagion:

Number of outbreaks in 1896 (six months)	218
Number of outbreaks in 1897 (six months)	80
Difference	138
Number of head lost in 1896 (six months)	12,849
Number of head lost in 1897 (six months)	1,111
Difference	11,738

These figures show that 138 fewer premises were affected and 11,738 fewer hogs died in the season of 1897, while the "stamping-out" methods were enforced, than for the same period in 1896. The total cost of this work, which included remuneration for slaughtered animals, was \$10,157.12. It is assumed that if the average weight of the 11,738 hogs was 100 pounds, and their value 3 cents per pound, the saving to the eight townships under consideration was \$35,214, a sum very much greater than the total expenses. It is true that the eradication of these diseases from a State by the "stamping-out" process would occasion the expenditure of a vast sum of money, and would cause more or less inconvenience and arouse some opposition. This plan has not been pursued, because the serum treatment promised equally good results without the slaughter of all animals in an infected herd, and consequently at comparatively slight expense, thus avoiding the inconvenience and irritation which invariably follow the more arbitrary measures.

BLACKLEG WORK.

When the Bureau of Animal Industry undertook to investigate the prevalence of blackleg in the United States it was merely known that the disease existed in certain districts. From its recent investigations, it is "apparent that the loss from blackleg in certain portions of several States exceeds that from all other causes combined."¹ While this disease is infectious, it has not been considered necessary to quarantine it at any time. The results of investigations of the Bureau indicate very decidedly that the disease may be eradicated by inoculation and proper disinfection of premises.

At the beginning of this work the Bureau saw the necessity for a "single" vaccine, that is, a vaccine which when used once would

¹Dr. V. A. Nörsgaard, Fifteenth Annual Report of the Bureau of Animal Industry.

produce the same immunity as is produced by two vaccinations, or with a "double" vaccine. The use of the double vaccine involved the treatment of each animal twice, with an interval of ten days between the two inoculations. This work, when considered in connection with the large herds of the West, where it is necessary to each operation that the cattle be "rounded up" from a large section of country, oftentimes scores of miles in extent, involves much inconvenience and expense, and it never became popular with the cattle raisers. In July, 1896, Dr. V. A. Nörsgaard, then a veterinary inspector for the Bureau, after having made an investigation, and appreciating all the objections to the double vaccine, stated that it was "desirable that some vaccine which will produce immunity after one inoculation be introduced in this country." Accordingly, experiments were begun in the fall of 1896 for the purpose of preparing such a vaccine. Hundreds of thousands of doses have been mailed to cattle owners, who are enabled, by following the directions accompanying the vaccine, to inject it themselves without the aid of a veterinarian. Each person who receives the vaccine is requested to answer a series of questions after the season closes, in order that an estimate of the results of the work may be made.

In 1898 the total number of reports received from the States and Territories where the disease was most prevalent (namely, in Texas, Nebraska, Kansas, Colorado, Oklahoma, Indian Territory, North Dakota, and South Dakota) was 522, covering 127,369 head of cattle. Previous to 1898 the average annual loss in the same sections was about 14 per cent. During the same season the loss previous to vaccination was 3.63 per cent and after vaccination 0.54 per cent. There were 700 deaths after vaccination, many of which, as stated by cattlemen themselves, would not have occurred if the vaccine had been injected properly. These results were so satisfactory that vaccine has been sent to all applicants since. The number of doses thus sent out during the fiscal year of 1898 exceeded 500,000.

Thus, in this brief time the Bureau of Animal Industry has made it possible to reduce the losses of cattle from blackleg to a minimum, and it is proposed to continue the manufacture and distribution of the vaccine until its efficacy is well known to the cattle owners of the country, when blackleg, it is believed, will cease to be classed among our more destructive cattle diseases.

BOVINE TUBERCULOSIS WORK.

For some time past some of the States have been making efforts toward the eradication of bovine tuberculosis by the "stamping-out" method. The work of the Bureau in this connection is confined to the rejection at stock yards and abattoirs of animals so diseased and to the manufacture and distribution of tuberculin to State authorities,

by which it may be ascertained which cattle are diseased and which are not. During the last year 35,000 doses were sent out for such official use. It is not furnished for private tests.

INVESTIGATIONS OF OTHER DISEASES.

It must not be understood that the work of the Bureau has been confined to the diseases named above. The act creating the Bureau provides for the "extirpation of pleuro-pneumonia and other contagious diseases among domestic animals." All reports of outbreaks of such diseases are immediately investigated by an inspector and such action taken as is warranted in the premises.

INSPECTION OF EXPORT ANIMALS BEFORE SHIPMENT.

While the rigid inspection in connection with contagious pleuro-pneumonia and Texas fever largely reduced the number of diseased animals that was offered for export, the officials of Great Britain still insisted that cattle affected with contagious pleuro-pneumonia continued to reach their shores from the United States. In consequence of these statements, arrangements were made with the British officials to permit the presence of inspectors of the Bureau of Animal Industry at the post-mortem examinations in Great Britain of all animals supposed to be thus diseased. These inspectors commenced their work at London, Liverpool, and Glasgow on August 16, 1890, and on November 8, after post-mortem examination of 104,296 head of cattle, they reported that not one animal was found affected with the disease.

This inspection has been continued in Great Britain, but is supplemented by work under the act of August 30, 1890, which provides for the inspection before shipment of all export cattle, sheep, and hogs. This inspection at both ends of the line of shipment could not fail to be efficient. Regulations under the act mentioned were issued on October 20, 1890. The points where cattle are to be inspected are named, and the cattle passing the inspection are to be tagged and inspected again at the ports of export. Cattle arriving at the ports of export from other parts of the United States are to be inspected and tagged there. Animals are to be carried, after tagging, in thoroughly cleaned and disinfected cars. Proper notification by inspectors and shippers is required. The thoroughness of this work is such that the history of any animal tagged for export may be traced back to the farm whence it came.

Very few hogs have been exported alive. The numbers of cattle which have been inspected, tagged, and rejected in connection with this work are shown in the following table, also the inspections and exports of sheep. The number of inspections does not mean an equal number of animals, for most cattle and sheep for export are inspected twice, and so appear twice in the totals in the table.

Inspections of cattle and sheep for export, 1893-1899.

Fiscal year.	Cattle.			Sheep.	
	Number of inspections.	Number re-jected.	Number tagged.	Number of inspections.	Number re-jected.
1893.....	611,542	202	280,570	.....	.....
1894.....	725,243	184	300,580	135,780	.....
1895.....	657,756	1,060	324,830	704,044	179
1896.....	815,882	1,303	377,639	733,657	899
1897.....	845,116	1,565	410,379	348,108	189
1898.....	859,346	1,438	418,694	297,719	180
1899.....	643,301	1,593	327,741	174,717	118

INSPECTION AND QUARANTINE OF IMPORT ANIMALS.

One of the first steps taken for the control of contagious diseases among animals was the establishment of quarantine stations at the principal Atlantic ports, where imported animals might be detained until there was no longer any danger of the development of disease from exposure to contagion in other countries. This system has been extended so as to include the frontiers bordering upon both Canada and Mexico. The stations were at first under the Treasury Department, but soon after the organization of the Bureau of Animal Industry they were transferred to its control. The wisdom of maintaining them has been attested very often. When pleuro-pneumonia was eradicated it was not permitted to enter again from Europe, where it was prevalent, and rinderpest, which almost annihilated the herds of South Africa, was not allowed to gain a foothold here. Foot-and-mouth disease had appeared several times, but was turned back through the vigilance of the Bureau inspectors.

The records kept at these quarantine stations give the date of arrivals of animals, port of shipment, name of breed, number received, and name and address of importer. Large numbers of cattle and sheep come in from Mexico and also from Canada for feeding purposes, but those landed at the Eastern seaboard are principally for breeding, and are not in large numbers.

INSPECTION OF VESSELS THAT CARRY EXPORT CATTLE.

Reference has already been made to the fact that the Texas fever regulations governing interstate transportation of live stock were so efficient as to operate to reduce the losses usually occurring among export cattle. The reduction was so marked that the chief of the Bureau was enabled to say in his report for 1890 that—

On the whole the effect of these regulations has been extremely beneficial. As compared with former years, but a small amount of the disease has been reported

either in the United States or among cattle abroad. The losses during the ocean voyage have been so much less than usual that insurance is said by shippers to have been reduced over 50 per cent. If this statement is correct, it means a saving of over a million of dollars to our shippers by this reduction of insurance alone.

There continued to be losses at sea, however, that seemed to be unnecessary, and which were due in most cases to the improper construction of the ships engaging in the trade. The ventilation was very bad, proper facilities for feeding and watering were wanting, space was badly overcrowded, the ships were sometimes unseaworthy, and the attendants were often inexperienced and worthless. While all this was bad enough, there never were such cruelties practiced as were charged in English papers and documents, inspired partly by sensationalism and partly by commercial interests. However, the defects mentioned and many other similar ones in connection with the ocean transportation of cattle were such as might easily be avoided under proper supervision. This power of supervision was given by the act of March 3, 1891, by which the Secretary of Agriculture was authorized to examine all vessels which are to carry export cattle from the ports of the United States to foreign countries, and to prescribe by rules and regulations or orders the accommodations which said vessels shall provide for export cattle "as to space, ventilation, fittings, food, and water supply, and such other requirements as he may decide to be necessary for the safe and proper transportation and humane treatment of such animals." Regulations were formulated in accordance with this act which were acceptable to the British Government. They were modified from time to time as necessities arose, until now they appear to be all that can be desired. The first result of their rigid enforcement was to drive the poorer class of ships out of the trade. Magnificent steel ships were constructed for the cattle traffic, having every convenience, with permanent fittings built into the vessels, and all the comforts and safety which ingenuity could provide. The number of inspections of vessels have averaged about 900 a year.

These regulations, supplemented by the inspection of animals in the interior of the country and their reinspection at ports of export, insure the landing of animals in Great Britain in the best possible condition. It is stated upon authority that, as a direct result of these improved conditions, the insurance rates on cattle have been reduced from \$8 to less than \$1 per head. A saving of \$7 per head on the 397,879 exported in 1898 amounts to \$2,785,153, while the expense was less than \$50,000. The work should, in addition, be credited with the improved condition of live animals delivered.

It is interesting in this connection to note the percentage of losses at sea of cattle and sheep since this work was undertaken by the Bureau. The table following gives the figures:

Percentages of losses of cattle and sheep at sea, 1891-1899.

Fiscal year.	Cattle.	Sheep.
1891 <i>a</i>	1.6	1.7
1892 .....	.875	.....
1893 .....	.47	.....
1894 .....	.37	1.29
1895 .....	.62	2.7
1896 .....	.32	1.16
1897 <i>b</i> .....	.57	1.29
1898 <i>c</i> .....	.22	.8
1899 <i>d</i> .....	.31	1.54

a Includes four and one-half months of 1890.

b With animals shipped from Canada the losses were: Cattle, 1.83 per cent; sheep, 2.17 per cent.

c With animals shipped from Canada the losses were: Cattle, 0.32 per cent; sheep, 1.39 per cent.

d The loss on horses shipped was 1.11 per cent.

On account of variation in conditions and weather, a uniformly low percentage can not be maintained.

GENERAL INSPECTION OF ANIMALS AND THEIR PRODUCTS.

An act of Congress approved August 30, 1890, provided for the inspection of meats for exportation, but this was supplemented on March 3, 1891, by an act "for the inspection of live cattle, hogs, and the carcasses and products thereof which are the subjects of interstate commerce, and for other purposes." It is doubtful if Congress, in passing this law, contemplated the magnitude of the work and expense thus placed upon the Bureau of Animal Industry. The organization of a force competent to conduct a work so extensive required years of training. It was not, therefore, until 1897 that the chief of the Bureau was able to say that "during the past year all of the beef exported to Europe, and the greater part of the pork and other meat products exported, have been inspected in accordance with law."

The regulations for this inspection are most rigid, and laxity in enforcement is never permitted. The proprietors of slaughterhouses and packing houses which prepare meat for interstate or foreign commerce must apply to the Secretary of Agriculture for inspection, whereupon there is given to the establishment a number which is used by the owners of the establishment and the inspectors to mark all products issuing therefrom. An inspector of the Bureau is stationed at each establishment, and among his duties is the ante-mortem examination of all animals arriving at the stock yards which are intended for slaughter at abattoirs where the Department has established inspection. When the inspector finds an animal unfit for human food he fastens in his ear a metal tag stamped "U. S., condemned," and a serial number. These condemned animals are at once removed by the owners and disposed of in accordance with State

law or municipal ordinance. Animals are condemned when found upon ante-mortem or post-mortem examination to be affected as follows: Hog cholera; swine plague; charbon, or anthrax; rabies; malignant epizootic catarrh; pyæmia and septicæmia; mange or scab in advanced stages; advanced stages of actinomycosis, or lumpy jaw; inflammation of the lungs, the intestines, or the peritoneum; Texas fever; extensive or generalized tuberculosis; advanced state of pregnancy or recent parturition; any disease or injury causing elevation of temperature or affecting the system to a degree which would make the flesh unfit for human food; immaturity, or too young to produce wholesome meat; emaciation and anaemia sufficient to render meat unwholesome; distemper, glanders, and farcy, and other malignant disorders; acute inflammatory lameness, and extensive fistula. Any organ or part of a carcass of an animal which is badly bruised or affected with tuberculosis, actinomycosis, cancer, abscess, suppurating sores, or tapeworm cyst must also be condemned.

The carcasses of animals condemned upon post-mortem examination are properly marked and then placed in a room, which is in charge of the inspector, to remain until they can be "tanked" or removed under supervision to a rendering establishment. If the owners of the carcasses do not consent to such disposition the carcasses are marked with the condemnation tag, and all express companies and common carriers are notified of the particulars and warned not to transport them out of the State. To remove a condemnation tag renders one liable to prosecution.

All carcasses leaving such establishments for local, interstate, or export trade are marked with a numbered tag or branding stamp, and a record kept in detail. Carcasses or parts of carcasses which are to be used for canning purposes are not to be tagged, but when shipped from one abattoir to another the cars carrying them are sealed and tagged on both sides. Each article of food product made from inspected carcasses, whether in cans, barrels, firkins, kits, boxes, or canvas, must bear a label giving the official number of the establishment from which the product came, and also containing the statement that it has been inspected under the law. All such packages to be shipped to any foreign country or to another State must have printed or stenciled on the side or the top the information that it is for export or for interstate trade, giving the official number of the establishment, the number of pieces or pounds, the shipping marks, and the date of the act under which inspected. The inspector then affixes the stamp of the Department of Agriculture. Certificates are issued by the inspector for all carcasses examined and for every consignment of canned meats.

The appropriation acts since 1898 carry a provision "that live horses and the carcasses and products thereof be entitled to the same inspection as other animals, carcasses, and products thereof" that are named

in the acts. Only one abattoir for the slaughter of horses was in operation during the year that regulations under this provision of law have been in force. The number of horses inspected was 3,232, of which number 181 were condemned on post-mortem examination. It is required that all packages containing horse meat be so marked as to indicate the fact, and no other animals may be slaughtered at abattoirs where horses are slaughtered.

The work of general meat inspection has had a wonderful growth during the nine years of its existence. The number of animals inspected before slaughter was 3,809,459 during the fiscal year of 1892, whereas the number for the fiscal year of 1899 was 34,405,973. The number of abattoirs and packing houses in operation in 1891, when inspections were begun, was 22. It increased in 1892 to 38, and in 1899 to 138. The latter are located in forty-one cities. The following table shows the number of animals of all kinds which have been inspected before slaughter for abattoirs since the beginning of the work:

Number of animals inspected before slaughter for abattoirs having inspection, 1891-1899.

Fiscal year.	Cattle.	Calves.	Sheep.	Hogs.	Horses.	Total.
1891.....	83,891					83,891
1892.....	3,197,009	59,089	583,361			3,809,459
1893.....	3,022,174	92,947	870,512			4,885,633
1894.....	3,862,111	96,331	1,020,764	7,964,850		12,944,056
1895.....	3,752,111	100,941	1,344,031	13,576,917		18,783,000
1896.....	4,050,011	213,575	4,710,190	14,301,963		23,275,739
1897.....	4,289,058	259,930	5,179,643	16,813,181		26,541,812
1898.....	4,552,919	241,002	5,706,002	20,713,863		31,213,966
1899.....	4,654,842	245,859	5,718,464	23,783,576	3,232	34,405,973

While the above table shows an enormous increase in the number of animals inspected from year to year, the number of animals rejected has not increased in like proportion. This indicates that the farmers of the United States are placing upon the market a healthier lot of animals than formerly. A table showing the different species of animals rejected upon ante-mortem and post-mortem inspections for the period of 1896 to 1899, inclusive, is given herewith; the figures for previous years are not considered accurate:

Number of animals rejected upon ante-mortem and post-mortem inspections, 1896-1899.

Fiscal year.	Cattle.	Sheep.	Calves.	Hogs.
1896.....	31,113	17,590	3,874	97,170
1897.....	35,489	15,998	3,202	104,593
1898.....	37,613	12,902	2,850	132,741
1899.....	36,296	23,471	3,473	162,953

OTHER INSPECTIONS.

The preceding statements do not show all of the work in connection with general meat inspection. Besides animals inspected for immediate slaughter, many thousands are inspected for shipment to other cities and for miscellaneous buyers. The following table shows the magnitude of this work:

Number of animals inspected for shipment to other cities and for miscellaneous buyers, 1895-1899.

Fiscal year.	Cattle.	Sheep.	Calves.	Hogs.
1895.....	1,083,013	648,358	10,708	3,360,642
1896.....	3,479,512	1,608,094	101,271	7,452,863
1897.....	3,960,967	2,864,712	180,053	8,753,563
1898.....	4,675,318	4,322,195	227,107	10,896,812
1899.....	4,288,562	3,119,920	253,404	10,455,317

MICROSCOPIC INSPECTION OF PORK.

In 1881 the importation of American pork into Germany, France, and the principal countries of the continent of Europe was prohibited on the assumption that it was infested with trichinæ, and was therefore injurious to health. Although it could not be shown that American pork had caused disease, it being manifestly more wholesome than European pork, and notwithstanding the most vigorous protests by this Government, the trade was crushed and destroyed. The year before the prohibition went into effect the United States sold to France 70,000,000 pounds of pork, and to Germany 45,000,000 pounds. For ten years thereafter American pork was shut out of nearly every market of continental Europe, and the prohibition was not raised until the Bureau of Animal Industry began the microscopic inspection and certification of pork destined for those markets. The trade had to be built up anew over the prejudices that had been so firmly rooted, and it has been a slow and difficult process. Vexatious and burdensome restrictions have constantly to be met, but the trade has continued to grow notwithstanding. During the fiscal year 1892 there were 38,152,874 pounds inspected for export, 22,025,698 pounds going to countries requiring inspection and 16,127,176 to countries not requiring it, while in 1899 the total shipment was 108,928,195, of which 108,858,149 went to countries requiring inspection and 70,046 to countries not requiring it.

The regulations for this work provide that a microscopic examination be made of all hog products which are for export to countries requiring such examination. The following extract from the regulations shows the method of operation:

When the slaughtered hog is passed into the cooling room of said establishment, the inspector in charge, or his assistants, will take from each carcass three samples of muscle—one from the "pillar of the diaphragm," one from the psoas

muscle, and the other from the inner aspect of the shoulder, and also from the base of the tongue when that organ is retained for exportation; and said samples will be placed in small tin boxes, and a numbered tag will be placed upon the carcass from which said samples have been taken, and a duplicate of said tag will be placed in the box with said samples. The small boxes will be placed in a large tin box provided with a lock. The boxes containing the samples from the hogs in the cooling room so tagged will be taken to the microscopist for such establishment, who shall thereupon cause a microscopic examination of the contents of each box containing samples to be made, and shall furnish a written report to the inspector, giving the result of said microscopic examination, together with the numbers of all carcasses affected with trichinæ. The samples of pork microscopically examined shall be classified as follows:

Class A.—Samples in which there are no signs of trichinæ, living or dead, calcified cysts, or other bodies or substances having any resemblance to trichinæ or trichinæ cysts.

Class B.—Samples in which there are disintegrated trichinæ or trichinæ cysts, calcified trichinæ or trichinæ cysts, or bodies having any resemblance thereto.

Class C.—Samples in which there are living or dead trichinæ bodies not disintegrated.

All carcasses coming within Class C are removed from the cooling room and disposed of by tanking, or they may be rendered into edible lard at a temperature of 150° F., or made into cooked meat products if the temperature is raised to the boiling point a sufficient time to cook thoroughly the interior of the pieces. Carcasses belonging to Class B are rejected for shipment to countries requiring inspection and certification. In all this work (the microscopic examination, the cutting up of carcasses, the marking of parts, and the keeping of records) the most careful and painstaking efforts are maintained. The result is that the pork exported to countries which require inspection is not only absolutely free from trichinæ, but has never been affected by these parasites. The amount of affected pork under Class B and Class C is less than 2 per cent of the whole amount examined microscopically.

The following table shows the amount of pork examined microscopically for export to countries requiring the inspection and to countries not requiring it for the fiscal years 1892 to 1899, inclusive:

Pork inspected microscopically for export, 1892-1899.

Fiscal year.	To countries requiring inspection.	To countries not requiring inspection.	Total.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1892.....	22,025,698	16,127,176	38,152,874
1893.....	8,059,758	12,617,652	20,677,410
1894.....	18,845,119	16,592,818	35,437,937
1895.....	39,355,230	5,739,368	45,094,598
1896.....	21,497,321	1,403,559	22,900,880
1897.....	42,570,572	1,001,783	43,572,355
1898.....	120,110,356	161,303	120,271,659
1899.....	108,858,149	70,046	108,928,195

Before this work was undertaken, it was estimated that it would cost from 15 to 50 cents per carcass, but in fact the cost has been only about 6 cents per carcass. The cost per pound of the pork exported was 0.248 cent in 1894, 0.2 cent in 1895, 0.264 cent in 1896, 0.256 cent in 1897, 0.142 cent in 1898, and 0.182 cent in 1899. There were many and strong objections to the work of microscopic inspection when it was begun, but the results have been so gratifying, especially from a commercial point of view, that not only is there little criticism, but the applications for inspection are numerous. While there is room for discussion of the proposition as to whether the packer or the Government should pay the cost of the microscopic inspection, there is no longer any doubt of the wisdom of having the inspection made under the supervision of the Government.

EXPERIMENTAL EXPORTS OF DAIRY PRODUCTS.

Early in the year 1897 a series of experimental exports was begun, under the supervision of the dairy division of the Bureau of Animal Industry, by which choice butter and cheese made in the United States have been offered for sale in various foreign markets in competition with the best products of like kind from other countries. The object was to obtain information which might be of use to those wishing hereafter to sell such products in foreign markets. By practical operations under usual commercial conditions, although upon a small scale, it was possible to determine the wants of different markets, the peculiarities desirable in the products themselves or in their form of preparation, the incidental expenses, the facilities for transportation, the effects of long journeys, and the comparative merits of the dairy products of this and other countries. These experiments have been continued during the years 1897, 1898, and 1899, the shipments being made weekly most of the time and at greater intervals for a part of it.

Special agents for the Bureau of Animal Industry have visited foreign countries to investigate markets and determine where sales agencies should be established. Exports have accordingly been made to England, Germany, China, Japan, the Hawaiian Islands, Cuba, and Porto Rico.

These trials have resulted in showing that the markets of Great Britain are by far the best for butter and cheese from the United States, if these products are to be exported. They offer the most active and continuous demand, the most discriminating judgment, and the best prices.

American cheese is the equal of any found in British markets, when it is carefully made and cured, and some lots sell at highest prices; but collectively, it now occupies a position secondary to the Canadian product, because of the patronage of the dairy industry by that Government and the official guaranty which it offers as to the purity and uniform high quality of all cheese exported from the Dominion.

THE INTERNATIONAL CONGRESS FOR THE CONSIDERATION OF THE BEST METHODS FOR CHECKING OR CURING TUBERCULOSIS.

By E. A. DE SCHWEINITZ, PH. D., M. D.,

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The International Congress for the Consideration of the Best Methods for Checking and Curing Tuberculosis was held in Berlin May 24-27, 1899. Her Majesty the Empress of Germany was patroness of the congress, and the Imperial Chancellor, Prince Hohenlohe-Schillingfürst, was the honorary president. The honorary executive committee was composed of their Excellencies Count Posadowsky-Wehner, the secretary of state of the German Empire, Count von Lerchenfeld-Köfering, Dr. D. Bosse, minister of state and minister of education, and General von Coler, surgeon-general of the army. The Duke of Ratibor, president; Professor von Leyden, vice-president; Privy Councillor von Mendelsohn-Bartholdi, treasurer; and Dr. Pannwitz, general secretary, constituted the organization committee.

The Red Cross Society, which encouraged the movement for calling this congress and which has rendered invaluable aid to the tuberculosis in Germany, was represented by the chairman of the central committee of the Red Cross and many of the most prominent members of the society. Great interest also was shown by the women, who were assiduous in making the congress a success and were attentive listeners to the discussions.

The meetings of the congress were held in the Reichstag building, permission for the use of which had been granted, as the Reichstag had adjourned for the Whitsuntide holidays.¹

At 11 a. m., on May 24, the congress was opened in the presence of Her Majesty the Empress of Germany and her attendants, their excellencies before named, and many of the most prominent of the German nobility, professors of universities, hygienists, and many interested members and delegates. There were more than 2,000 members of the congress and about 225 delegates sent by twenty-five foreign countries and the different provinces of the German Empire. The United States, Belgium, Canada, England, France, Denmark, Guatemala, Japan, Italy, Mexico, Monaco, Montenegro, Nicaragua, Holland, Austria, Hungary, Persia, Portugal, Russia, Norway and Sweden, Switzerland, Servia, and Spain were the principal countries represented. The fact

¹ This concession of the German senate chamber and the interest shown by the Emperor and the German Government in the congress deserves especial note.

that many of these countries had sent some of their most prominent men, as Brouardel, Metchnikoff, Nocard, and Landouzy from France and Weber and Stewart from England as delegates, was evidence that this congress was regarded by the civilized world as one of far-reaching importance. The representatives from the United States were Dr. Boyd, assistant surgeon-general of the Navy Department; Dr. Vaughan, United States Marine-Hospital Service; Dr. Ch. Wardell Stiles, for the Army; and Dr. E. A. de Schweinitz, for the Department of Agriculture.

A large number of the members were laymen, as one object of the congress was to interest all classes and professions in the important subjects under discussion.

The papers were considered under five different heads, namely: (1) Distribution of tuberculosis; (2) the causes of tuberculosis; (3) the different methods of guarding against tuberculosis; (4) the various methods of treating tuberculosis; and (5) sanitariums for the care of the tuberculous.

The first paper presented to the congress, read by Köhler, the president of the German health office, contained a review of the distribution of tuberculosis in Europe. According to his well-prepared tables and statistics, the percentages of loss from tuberculosis at the present time, as compiled from the most complete data available for Europe, are as follows:¹

Deaths per million of population.

Russia	3,986
Austria	3,625
Hungary	3,184
France	3,023
Sweden	2,310
German Empire	2,245
Switzerland	2,031
Ireland	2,029
Denmark	1,912
Netherlands	1,884
Italy	1,871
Belgium	1,767
Norway	1,737
Scotland	1,727
England	1,358

Brief abstracts of some of the papers of special importance are as follows:

Professor Dr. Bollinger, of Munich, presented a paper upon "The relation of tuberculosis of animals to the distribution of this disease among men." His conclusions, which are supported by modern

¹Available statistics for the United States indicate a slightly lower death rate than in any of these countries, which would be expected on account of its greater extent of territory and less dense population.

researches, were that the tuberculosis of cattle and swine is of the same origin as tuberculosis of men, and consequently is not only of immense importance in regard to the distribution of disease among other animals, but also causes serious danger to the health of men. He thinks that tuberculosis of men plays a rather unimportant rôle so far as the cause of tuberculosis of domesticated animals is concerned. The infectiousness of the flesh of tuberculous cattle increases, of course, with the amount of disease in the animal, but any danger from it can be avoided by using only thoroughly cooked meat. Milk and nonsterilized milk products which come from tuberculous cows are, of course, the most dangerous for man. This is especially true in the case of young children and weak individuals. The fact that swine fed upon milk from tuberculous cattle so often show disease is one of the evidences that tuberculosis may be contracted in this way. The distribution and localization of tuberculosis in children is also in part to be attributed to the infection of food brought about by the use of infectious milk.

The first step toward the active elimination of the danger which threatens man from tuberculosis of domesticated animals is, of course, thorough carrying out of an obligatory meat inspection. A careful meat inspection has shown the following increase in tuberculosis in various localities in Germany: In Baden, 1888 to 1897, from 1.6 to 3.56 per cent; in Leipzig, 1880 to 1897, from 11 to 36.8 per cent; in Scheerin, 1886 to 1893, from 10 to 26 per cent; in Zwickau, 1894 to 1897, from 26 to 45 per cent; in Chemnitz, 1896 to 1898, from 20.8 to 25.2 per cent. In Bavaria, during the years 1895 to 1897, tuberculosis was found as follows: 0.03 per cent in calves, 1.5 per cent in young cattle, 3.1 per cent in bulls, 4 per cent in oxen, 11 per cent in cows.

The increase in cattle tuberculosis with the increased age of the animal depends, of course, upon its longer association with the other diseased animals. Similar to tuberculosis in adult man, the tuberculosis of older cattle usually begins in the lungs, while in calves and young cattle the lymphatic glands are more apt to be the seat of the first infection.

In middle Europe in the sixteenth and seventeenth centuries and the beginning of the present century, tuberculosis of cattle was a rather uncommon disease. Gradual increase of the disease has occurred in the second half of the present century and a rapid increase in the last twenty years. A very important factor in all probability in this increase in tuberculosis in cattle is due to the fact that a very much smaller number of animals have the freedom and extensive grazing opportunities that formerly existed, and are kept for a greater length of time in close, badly ventilated buildings. The character of the food of the animals and the continued inbreeding are probably also very important factors in this connection. These causes may be compared to the conditions which are conducive to the production of

tuberculosis in men who live often in prisons and penitentiaries. The importance of these influences in increasing tuberculosis in animals is evidenced by the fact that in certain races, as the buffalo, it appears to be entirely absent, while animals that are raised on the plains or in the mountains show very much less tuberculosis than those raised among more artificial surroundings.

The tests which have been made by the agricultural department of Switzerland have shown that there is much less tuberculosis among the cattle in the mountainous districts than in the cattle in low countries, especially those in the neighborhood of larger cities where the animals are kept under less natural surroundings.

In connection with the dangers of tuberculous milk for children, Professor Seitz, of the Polyclinic, in Munich, determined that about 68 per cent of the children there treated had parents that were not tuberculous and that had not in their younger years shown any tuberculous symptoms.

With reference to the health of men, tuberculosis of cattle and swine is, therefore, one of the most important and dangerous of animal diseases, and one which should be very carefully controlled, and, if possible, exterminated by the State.

Dr. F. Loeffler, of Grieswald, presented a paper upon "The natural disposition to tuberculosis and its inheritance." According to him, tuberculosis in the newly born is a matter of such rare occurrence (even if it has been proven at all) that heredity from a practical standpoint need not be considered at all. He claims, further, that the existence of an inherited disposition toward tuberculosis has never been proven, although it is very probable that other diseases of the respiratory and digestive organs are conducive to a greater susceptibility to infection.

Prof. Dr. Rudolph Virchow, of Berlin, presented a paper upon the character of the food for the tuberculous. He held that the milk and meat of animals should be used as food only after the animals have been subjected to the tuberculin test and found to be perfectly free from disease. The sale of raw milk of animals which had not been submitted to the tuberculin test, or had shown a positive reaction when this test was applied, should not be allowed. Its sale should be permitted only after the milk had been sterilized. The fact that various forms of tuberculosis are so often found in swine is good reason for using the strictest methods in inspecting those animals that are slaughtered and deciding upon the character of the meat from them which should be used as food. He thinks that the identity of tuberculosis of fowls with the tuberculosis of men and other animals has not yet been fully established, and that, so far as fowls are concerned, the problem can best be handled by an effort to exterminate the disease among them. So far as the inheritance of tuberculosis is con-

cerned, he claims that there is not the slightest evidence to show the direct inheritance of this disease, but, on the contrary, experimental data have demonstrated that there is not the slightest evidence whatsoever to prove the existence of such inheritance.

Prof. Dr. Flügge, of Breslau, presented a paper upon the relation of the tubercle bacillus to tuberculosis. Reviewing the relation of this bacillus to the disease from the time of Koch, he points out the well-known fact that it has been the cause of the various forms of tuberculosis in man, and also that the same parasite causes the disease in cattle. He calls attention to the fact that some recent workers have noted the presence of a bacillus somewhat similar to the tubercle bacillus which resists decoloration with acid, but they are more easily discolored with acid than the genuine tubercle bacilli. They are stained in other methods which will easily differentiate them and show other biological characteristics which distinguish them very readily from the genuine tubercle bacilli.

While Koch originally claimed that the tubercle bacillus could not be grown satisfactorily outside of the animal body except upon blood serum, the work of Nocard, Roux, and others, and of Trudeau, de Schweinitz, and others in the United States, have shown that there are various media upon which the tubercle bacillus can be grown, even upon solutions entirely free from peptone, and upon solutions containing simple carbohydrates together with certain mineral salts.¹

Prof. Dr. C. Fränkel, from Halle, presented a paper upon the manner in which tuberculosis is transmitted. The conclusions from his article are best stated in his own words:

All men and animals from which tubercle bacilli are at one time or another thrown off are a source of infection. Outside of the animal body the bacilli do not increase, and are easily destroyed in drying and by the action of light. As a rule, the infection of individuals occurs only when they have been exposed a number of times to tubercle bacilli or have associated continually with tuberculous sick. Therefore we find a greater distribution of tuberculosis in families where the disease exists, or among people who occupy close, ill ventilated rooms, or are associated in such quarters during their work. Man can become infected with tubercle bacilli either through the skin or mucous membrane, through the stomach or intestines by means of milk, through butter or meat from tuberculous animals, etc., or through the lungs. Among older people infection through the lungs is the largest, and takes place when they breathe the air which has been contaminated by the coughing and sneezing of tuberculous individuals, or where this air is infected with tubercle bacilli that comes from the expectoration or from the handkerchiefs, clothing, or bed linen of tuberculous individuals.

Professor Dr. Rubner, of Berlin, presented a paper upon the care and protection thereby which could be secured from tuberculosis in

¹ From all of this work, and the results obtained by Nocard in the study of the changes which the human tubercle bacillus undergoes in the peritoneal cavity of fowls, there can be but little doubt that the tubercle bacillus accustoms itself fairly readily to these surroundings, both inside and out of the animal body, as I have claimed for a long time.—E. A. DE S.

proper living and working rooms. His paper referred more especially to tuberculosis in men, but many of the precautions which he gives are equally necessary for preventing tuberculosis among animals. Where men are crowded together in small, ill ventilated rooms, sleep in the same rooms in which they work, and where often a room with sufficient cubic air space for one individual is occupied by more than one the worst possible conditions exist for spreading tuberculosis, if, perhaps, one of the individuals in the room is affected, or, if not that, then in rendering the individuals more susceptible to this disease. Exactly the same conditions apply in regard to animals. Tuberculous animals in small stables which are dark, ill ventilated, and dirty are excellent sources of infection for other animals which may occupy the same stable. Cleanliness and plenty of fresh air and light are just as necessary for ordinary animals as for men.

Of the papers presented which treat of the different methods of treating the tuberculous, the one by Brieger, of Berlin, upon the use of tuberculin and similar preparations deserves mention. According to him both the old and the new tuberculin are specifically acting materials. As is well known, the old tuberculin¹ has great value as a diagnostic means in determining the presence of disease both in men and animals.

The tuberculin acts as a specific upon tuberculosis only and not upon secondary infection. According to Brieger, incipient and pure tuberculosis is often improved by the use of tuberculin. While the influence of tuberculin may be but small and short lived, this fact necessarily suggests the idea that in all probability tuberculin has not been used in sufficient quantity for a sufficiently long time. Often in cases with secondary infection the tuberculin appears to cause improvement. For these reasons, therefore, it would seem that tuberculin might be used to advantage in sanitariums.²

A paper was presented by Dr. Landerer, of Stuttgart, upon the treatment of tuberculosis in men with cinnamic acid. According to his report, very satisfactory results had been obtained.

Papers upon the treatment of tuberculosis with serum were presented by Maragliano, of Genoa, and de Schweinitz, the writer of this review. The results reported by Maragliano in the treatment of disease with serum were practically the same as those which have been already reported in many journals. He claims, with good reason,

¹By the old tuberculin is, of course, meant the tuberculin as originally prepared, in which all the products found in the culture media and the contents of the germs themselves are used. By the new tuberculin is meant the solution made by extracting the bodies of the germs only.—E. A. DE S.

²The opinions expressed by Brieger have been confirmed by some individuals and contradicted by a great many more. In all probability, however, as Brieger has indicated, the trouble in the use of tuberculin by many physicians is due to the fact that they have used it carelessly and have not had sufficient patience to wait or note carefully the results.—E. A. DE S.

that the healthy individual can naturally protect itself against tuberculosis; that in disease, if we can administer a substance which will neutralize the poisonous products that are produced by bacteria we aid the natural functions of the body, and if this treatment, coupled with proper hygienic surroundings, is continued, good results are usually obtained.

De Schweinitz's paper gives the report of a number of cases treated at the Loomis Sanitarium in New York with a serum prepared from horses which have been treated with attenuated tuberculosis cultures. Instead of subjecting the cultures to the action of heat and antiseptics, as is usually done in the preparation of tuberculin, he makes an extract of the cell contents of the germs, as free as possible from fat, and injects this into the animals which are to serve as a source for the serum. In this way he thinks that the useful products of the tuberculosis culture, without the deleterious products, are caused to react upon the animal which is to serve as a source for the serum. The body of the tubercle bacillus contains a large percentage of fat, which acts in all probability in the body as a protective agent to the action upon the germs of the surrounding leucocytes. In order to obtain satisfactory results, it would appear to be necessary, therefore, to remove this fat from the germs so far as possible and inject into the animals the products of the bacilli under conditions as near as possible to those which probably exist when the germ has gained access to the animal body. He also holds that the serum is best used as an aid to hygienic treatment.

The results reported from the sanitarium upon 90 cases treated show, according to the physician in charge, 19 per cent cured, 57 per cent somewhat improved, and 17 per cent unimproved. The physician in charge of the sanitarium also holds that the patients which are cured or improved under the action of the serum treatment retain their improved condition better and for a longer time than those treated in other ways. The encouraging results secured point to the necessity of continuing the experimental work in the lines already begun.

The most of the other papers presented treated of the best methods of caring for the tuberculous individuals in sanitariums erected in suitable localities. Papers were also presented suggesting the erection of sanitariums in such localities that the individuals who were sent to them might at the same time have an opportunity of pursuing the work to which they were accustomed. In this way a more healthy condition of mind could be secured, which would naturally be conducive to better physical conditions.

The congress was an important one, in that it brought together many individuals who were interested in tuberculosis from a scientific standpoint, as well as many others who were interested in tuberculosis from a practical standpoint. The congress was called together

for the purpose of encouraging the movement for the establishment of sanitariums for the tuberculous poor especially, and undoubtedly many good results will follow, not only in Germany, but also in other countries. When we take into consideration the fact that the German Empire, with an area about equal to that of the State of Texas, has completed, or has in course of construction, or has projected about fifty sanitariums, we can see that they are very much more generally established than in this country. A very important reason in this connection, of course, is that these sanitariums are, to a greater or less extent, under Government control, and a system prevails in Germany which provides a fund for the care of the tuberculous poor. This, of course, has been of immense aid in extending the system. While in our country a number of good sanitariums exist, they are with few exceptions either under control of an individual or a number of individuals, generally for charitable purposes. Concerted movement in America for the erection of State and national sanitariums should be productive of good results. A united crusade against tuberculosis of men and animals, on the part of civilized nations, can be productive only of the best and most far-reaching results.

It is to be hoped that this congress will be but the beginning of other similar congresses which will aid in educating the laity and give more concerted action in the universal contest against tuberculosis.

At the conclusion of the congress the delegates were given a personal reception by the Emperor and Empress of Germany. Their Majesties took great interest in the proceedings of this congress and regarded it as of great importance.

SECOND OUTBREAK OF MALADIE DU COÏT IN NEBRASKA.

The first outbreak of *maladie du coït* (a venereal disease of horses) in Nebraska occurred in 1892, but no steps were taken for its eradication until June, 1893. Dr. George C. Faville, a veterinary inspector of the Bureau of Animal Industry, who investigated the disease, made his report on December 1, 1893. In this report he said:

One section of the country that should be carefully watched is the range country south of Gordon, in what is known as the sandhills. This range is about 60 miles west of the one where the Beckwith horse ran. With a possible danger in the locality indicated, we believe the disease to be completely eradicated.

This "possible danger" appears to have materialized in this second outbreak, which is herewith reported.

About the 1st of December, 1898, the Bureau of Animal Industry received information through a letter from Mr. John M. Kelly, of Gordon, Nebr., which led the officials to suspect that the disease of a horse described therein was *maladie du coït*. On December 28 Dr. Charles M. Day, a veterinary inspector of this Bureau, was directed to proceed at once to Gordon and make investigation. He arrived there on January 4, 1899, and immediately drove to the ranch of Mr. Kelly, who was the gentleman that had reported the condition of his stallion to the Bureau. This ranch is about 25 miles southeast of Gordon. Mr. Kelly stated that he had found it necessary to kill the horse about four weeks before Dr. Day's arrival, consequently the diagnosis had largely to be made from the history of the animal. This history, furnished to the Bureau by Dr. Day on January 10, 1899, is as follows:

CASE 1.—The horse was a large bay stallion, with a broad white strip down the face; was known as the Margrave horse, having been brought to Gordon, Nebr., about ten years ago by Mr. Thomas Margrave, who has since moved to Kansas, where he now resides. The horse was of Clydesdale and Belgium breed, and weighed in his best days about 2,000 pounds—always carrying considerable flesh. He was used for breeding purposes after his arrival at Gordon, being used on the stand at Gordon and allowed to run on the ranges in Sheridan County. During the two years previous to the summer of 1898 he was owned by Mr. John Jordon, of Gordon, and was used for breeding purposes on his ranch about 30 miles southeast of Gordon. This gentleman traded him to Mr. Rash some time during the summer of 1898, and he in turn traded him to Mr. Louis Henderson. About the 1st of November, 1898, the horse became the property of Mr. Andrew Henderson, who traded him to Mr. Kelly, but did not deliver him till November 8. Thus it is seen that a once valuable animal had become so that nobody cared to keep him, passing from one owner to another for a very small consideration each time. Mr. Kelly stated that he secured him by trading a mare, valued at \$15. The stallion was reported to have cost \$800 when he first came to the county. It is evident, however, that if any of the owners previous to Mr. Kelly noticed anything wrong

with the animal they did not reveal it; but Mr. Kelly said that the disease developed so rapidly and was so severe that he had to destroy the animal.

Mr. John Jordon stated that he did not notice anything wrong with the horse while he had him and had directed his foreman to breed all the mares on the ranch to him during the season of 1898. Mr. Johnson, who carries the mail, informed me that he had owned two large bay mares that he wished to breed to the Jordon horse in May, 1898. One of the mares was served all right, but the horse made a complete failure with the other one. He seemed very amorous; would frequently get an erection, but the end of the penis (glans penis) would become extremely large, and the penis itself would not remain rigid a sufficient length of time to permit the horse to serve the mare, which was probably due to an imperfect erection. After trying for three hours, during which time the horse seemed very amorous and very anxious to serve the mare, but failing as often as he made an attempt, the effort was given up, and the mare was never served by the horse. Mr. Johnson has since disposed of the mare that was successfully served by the horse and was not informed whether or not she ever showed any signs of the disease or was with foal.

Mr. H. P. Allen, who was employed upon Mr. Jordon's ranch, said that there were so few, if any, mares on the ranch that got with foal during the season of 1898 that it was necessary to get another stallion to place in the pasture with the mares. He also permitted his own 3-year-old stud colt to run with the mares after the Margrave horse (Kelly horse, or Jordon horse) was taken out. Mr. Allen showed me two of his mares that had been served by the Margrave horse, neither of them getting with foal; but one of them is now with foal, having been served by Mr. Allen's own colt. The other mare, light gray in color, is not with foal, and has been noticed frequently to urinate and often to be in heat since being bred to the Margrave horse.

I can find no other evidence that would indicate that the horse was diseased until his condition was noticed by Mr. Kelly two or three days after receiving him, on November 8. On this date Mr. Andrew Henderson drove the horse quite rapidly and a sufficient length of time to get him well warmed up. Mr. Kelly noted that the horse was looking very thin in flesh, and it was remarked that he had become so during the summer. Two or three days after receiving the horse Mr. Kelly observed that something was wrong with him. The penis was kept out all the time and seemed constantly to be in a state of erection. On examination by Mr. Kelly there was found a number of small black scales on the penis. One of these had been knocked off and an ulcer remained where the scale was attached. The sheath was very foul and dirty. On further examination he discovered a sore of the size of a silver half-dollar piece just around the opening of the urethra. About a week from this time the penis was swollen to about twice its natural size; it was kept constantly erected, and there was freely discharged a yellowish red substance which besmeared the hind legs. The condition became worse till the last days of November, when nearly the entire end of the penis was eaten away. The discharge continued to get worse. The very disagreeable odor, which had always been present, had now become so offensive that the presence of the animal could not be tolerated. He became very weak, staggered, and had a very irregular gait when walking. He maintained a ravenous appetite to the end, however, having eaten heartily on the day that he was killed. Mr. Kelly did not observe whether the horse had any desire to notice mares, as no opportunity was offered.

As stated above, the animal grew worse rapidly; the penis was swollen enormously; the sheath, scrotum, and testicles were also very much swollen; the edematous swelling extended along the abdomen nearly to the fore limbs; the odor became so offensive and the animal so weak that he was led out

the prairie and shot on December 1, 1898. On January 4, 1899, I went to where the carcass lay and made an examination as best I could. The extremely cold weather previous to this time had frozen the carcass so hard that a post-mortem was impossible. The coyotes had completely devoured the penis, scrotum, and testicles, so that an examination of those organs was out of the question. The edematous swelling along the abdomen and the thick yellowish discharge on the hind limbs could still be seen. The carcass was also very nearly devoid of flesh. I frequently interrogated the gentlemen who kindly gave me the above information as to whether they ever noticed any white spots on any part of the animal, but received an affirmative answer from none of them.

About this time Dr. Day heard of an outbreak of *maladie du coït* near Rushville, in the same county (Sheridan), and proposed, under general instructions from this Bureau, to investigate at once. His work there covered about five months. He was making inspections, observing closely the horses that were suspicious, and purchasing and killing those that were evidently diseased. In this case, as in all similar cases, many obstacles were encountered. There were those who would try to shield the condition of their horses when they knew that they were diseased and in all probability had *maladie du coït*. When it became necessary to purchase an animal exorbitant prices were sometimes asked, and much time was required to get the price down to a reasonable figure. On the whole, however, Dr. Day succeeded very well in these delicate duties. The Bureau was kept constantly informed of the progress of the work, and offered such advice and issued such instructions as seemed necessary in the premises. Dr. Day's reports on the cases under observation on this field are as follows:

CASE 2.—This is a case which I examined on January 6, and of which a report was made to the Bureau, and which is given above. I advised the castration of the animal, but Mr. Brown, the owner, was opposed to the proposition, preferring to receive a money consideration, and placing the value at \$30. This amount was paid, and the animal was killed on April 4.

Post-mortem.—Sorrel stallion, 3 years old; carcass poorly nourished; coat dry, rough, and dusty; three white markings around the root of the tail; large white ring around the anal opening; one large white spot in the skin on the inner surface of the thigh; sheath very foul, containing a large amount of sebaceous secretion that was deposited in the sheath and over the penis; a disagreeable and peculiar odor was emitted from the latter organ; when the penis was washed there appeared on the inferior surface a number of chalk-white spots; urethra contained a yellowish colored mucus; testicles hard to the touch, very large, and hanging pendulent; spermatic cord very large, about the size of a man's wrist.

CASE 3.—Light-gray mare, owned by Mr. Ira P. Keethler; about 12 years old; blind in right eye; thin in flesh; vulva and fundus covered with white spots in size from a grain of wheat to a kernel of corn on first appearance, but when the lip of the vulva was drawn to one side and the folds of the skin drawn out smooth, the white spots were about the size of a silver 25-cent piece. The mare has a good appetite, but is otherwise in poor condition.

History.—During the spring of 1898 the mare was observed to be in heat. She was bred several times to a stallion in the neighborhood owned by Mr. Dan Keethler, but did not get with foal. She ran on the range with Mr. Brown's horse during the winter season of 1896-97.

Post-mortem.—Light-gray mare; carcass fairly well nourished; coat was shed; besides the white spots on the anus, vagina, perineum, and mammary glands the mucous membrane of the vagina was highly congested, dark red in color, some spots being nearly black; the walls of the uterus thickened and light in color on the peripheral surface; internally the mucous membrane had a thick coating of a thick jelly-like substance about the consistency and color of a hog's liver. This dark jelly-like substance extended into both horns of the uterus. Both ovaries were badly affected, considerably enlarged—several times natural size. Internally the left ovary contained a large body of dark-red substance resembling lean meat, with a large spot in the center of a coagulated dark blood clot; right ovary contained a very large cyst, the anterior end of which was filled with straw-colored serum and the posterior half containing several necrotic foci and several deposits of a yellowish substance. The kidneys appeared normal; the spleen somewhat enlarged and covered with numerous red-colored eruptions or elevated papillæ; liver normal in appearance; mesenteric glands enlarged and congested and dark red in color.

CASE 4.—A bay mare with a white strip down her face and white hind legs; about 6 years old; in good flesh. On the vulva and fundus there appeared several small white spots, caused by the absence of pigment in the tissues. Owned by Mr. Ira P. Keethler.

History.—The mare had run on the range southwest of Rushville, 5 to 10 miles distant, with Mr. Brown's horse during the winter and spring of each year. She was frequently and persistently in heat during the spring and summer of 1898. She was bred a number of times, but failed to get with foal. The attempt to get her with foal was finally given up.

Post-mortem.—Carcass fairly well nourished; had shed coat; carcass opened by removing left side; mucous membrane of the vagina highly congested, dark red in color, containing numerous nearly black spots; walls of the uterus thickened, mucous membrane being covered internally with a dark-brown jelly-like substance over about one-half of the organ, the other half of the organ being congested, and ulcers in both horns. The left ovary was normal in size and appearance; it was not cut open; weighed $1\frac{1}{2}$ ounces; right ovary very much enlarged, enormous in size, weighing $25\frac{1}{2}$ ounces; it was not cut into, but has the appearance and feel of being distended with fluid. The kidneys, liver, and spleen have a healthy appearance; mesenteric lymphatic glands enlarged and congested, and dark red in color.

CASE 5.—I next visited Mr. E. Ireland's place, 10 miles south of Rushville, where 40 mares and 1 stallion were inspected. One light sorrel mare was found to be diseased, presenting the following symptoms: The mare was almost constantly in heat during the last winter, and was persistent; was bred, but failed to get with foal. There was considerable discharge from the vagina which matted the hair on the under side of the tail and which adhered to the thighs. On the vulva was a large nearly white spot. She was in good flesh. Mr. Ireland's place is where the disease is supposed to have started by an old gray stallion, Monarch, owned by Mr. Henry Elwanger and let to Mr. Ireland "on shares" for his services in 1895.

Post-mortem.—A sorrel mare, examined on April 13, 1899; I did not consider the evidence strong enough to condemn her; the discharge that was noted in my former report of the first examination has disappeared. The animal is in fine condition, fat, sleek, and smooth; the light color on the vulva remains the same, which indicates that the condition is natural, and so I concluded not to destroy her.

CASE 6.—Visited Mr. Carl Fisher's place, 5 miles southeast of town, and examined 5 mares. One of them presented the following conditions: Very old, very thin in flesh, very poor; a number of chalk-white spots on vulva, anus, and inferior surface of the tail; a large, raw ulcer extending across the upper end of the

commissure of the vulva; frequently in heat, and was bred last year several times but failed to get with foal.

Post-mortem.—Old mare; dirty white in color; carcass very much emaciated; coat rough and dusty; about two-thirds of the fundus chalk-white; the larger part of the skin on the vulva white, the depigmentation of the skin extending down between the thighs; also extensive depigmentation about the eyes and nose; mucous membrane of the vagina very pale in color; the uterus soft and flabby; ovaries large and hard; left ovary almost a complete cyst, filled with straw-colored serum; right ovary large and firm, containing a large black spot in the center; kidneys appear normal.

CASE 7.—Visited Mr. Evans's place and examined five mares. One was suspicious of being diseased; was very thin and in poor condition; had a number of small white spots on the inferior surface of the tail; considerable loss of pigment in the tissues of the edges of both eyelids. She was bred last year, but did not get with foal. These facts alone make her suspicious.

Post-mortem.—Old gray mare; carcass poorly nourished; hair rough, dry, and dusty; some depigmentation about the eyes; large number of white spots on the inferior surface of tail, on the fundus, and on the vulva; mucous membrane of the vagina pale in color, walls covered with a white slimy mucons; uterus soft and flabby; animal bred last year, but uterus contains no foal; ovaries large and hard, inside of both organs being dark, nearly black, in color; kidneys apparently healthy.

CASE 8.—I next visited Mr. Dan Keethler's place and examined his mares and one stallion. Found one gray mare, about 4 years old, affected with *maladie du coit*. Three large chalk-white spots were observed on the fundus.

History.—In the spring of 1898 she foaled a colt that was very weakly. It was of premature birth. It soon became covered with raw sores, and died when about two weeks old. The mare was bred again to Mr. Keethler's bay stallion, but did not get with foal. She was purchased from Mr. Ireland's herd, where she had been running on the range with infected horses.

Post-mortem.—Light-gray mare; destroyed by shooting in the brain; carcass in fair condition; three large spots on anus and one on lower end of vulva; mucons membrane of vagina light in color; uterus contained a well-developed fetus; uterus highly congested and thickened; right ovary enlarged and containing several small necrotic points, or foci, numerous small deposits of a bright yellowish substance and one large dark spot; left ovary normal in size and appearance; left kidney contains a thick oily-like substance; right kidney appears healthy and normal.

CASE 9.—Mr. Dan Keethler's stallion had served several mares, which makes him suspicious, but he presented only a slight indication of the disease at the time of this examination. One testicle was very large and one very small. A small red spot on the right side of the penis looked very unnatural. It was located about half way from the end. No white spots were observed at this examination. The horse was castrated later.

CASE 10.—I went to the farm of Mr. William Hunter, 15 miles northwest of Rushville, where I found a bay mare presenting the following conditions: Several large white spots on the anus and vulva; is not with foal; in fair condition of flesh; has a late last year's colt from copulation with an unknown horse on the prairie.

CASE 11.—This mare was only slightly suspicious, having only a few white spots as markings, but she had a good clear history. At the time of examination she had five small white spots on the vulva and anus; had raised a colt every year for several years and was then with foal; was reputed to be an excellent brood mare. This animal also belonged to Mr. Hunter, and was running out, as was the one above.

CASE 12.—Another large bay mare owned by Mr. Hunter, and running out on

the prairie, had several small spots on the vulva; was with foal; in good condition; without history to indicate that she was exposed.

Later reports on Cases 10, 11, and 12.—Decided not to be diseased. Upon second examination I came to the conclusion that they were not diseased. In Cases 10 and 11 the symptoms given in my first report were probably due to pregnancy; in Case 9 the conditions remain the same, which are very light, indicating the natural condition of the animal; the small white specks are natural and not due to the depigmentation of *maladie du coït*. As I am unable to connect these mares with any animal that has the disease, I concluded that I would not be justified in destroying them. Mr. Hunter lives about 15 miles northwest of Rushville, where he has been practically isolated from any known outbreak of the disease.

CASE 13.—At Mr. James Caldwell's place, 7 miles southeast of Rushville, I inspected 12 mares. One large dark-gray mare had a few white spots on the left side of vulva, which made her a suspicious case, especially as *maladie du coït* was on this place during the outbreak of 1893. At that time Mr. Caldwell had a stallion which was condemned by the agent of the Bureau of Animal Industry.

Later report.—Large dark-gray mare; remains the same as she did on first examination, March 6, 1899; the few small spots on the side of the vulva may be inherited. As I failed to find *maladie du coït* in the mare that I had previously destroyed for Mr. Caldwell, and not being able to connect his herd of horses with any animals that are diseased, I came to the conclusion that the mare was not affected.

CASE 14.—One small dark-gray saddle mare, about seven years old, had a large number of white spots on vulva and anus; was frequently in heat and served by the stallion several times; was persistently in heat, but not with foal; has a discharge of a light-colored mucus from the vagina which adheres to the vulva. The vulva has an uneven and swollen appearance.

Post-mortem.—Mare purchased and destroyed; carcass poorly nourished; numerous white spots on the vulva and anus, the white spots also extending down over the perineum to the mammary glands; the white spots about the size of a copper-cent piece, which gave her the appearance best described by the saying, "as spotted as a leopard;" the discharge was not so abundant as upon the first examination, but the vulva is uneven and irregular in shape; mucous membrane of the vagina dark red in color, a dark-brown discharge, with a disagreeable smell, pervaded the entire organ; the walls of the uterus somewhat thickened and pale in color externally; internally the surface of the mucous membrane is highly congested; one small ulcer in the left horn of the organ, and a highly congested spot in the right horn; about one-third of the organ has a dark-brown substance over its surface, with a pocket of yellowish colored pus at the os uteri. The mare was with foal last year, but aborted her fetus during the winter, which probably gave rise to the inflammation of the uterus; left ovary showing signs of previous inflammation, as about one-half of the organ was dark brown in color when cut through; right ovary had a healthy appearance; mesenteric lymphatic glands slightly enlarged; considerable serum in thoracic cavity.

CASE 15.—At Mart Henderson's I examined 10 mares, all appearing well except one little old Indian pony, with a "glass eye" on the left side; strawberry roan in color; very thin in flesh; vulva swollen and irregular in size and shape, having bunches on the surface; several small white spots on vulva and anus.

Post-mortem.—Carcass small and thin; numerous small white spots on fundus and vulva, the latter organ much swollen and irregular in shape and rough; some depigmentation about the eyes; vagina dark purple in color; walls covered with mucus; uterus thick and hard to the touch; walls covered with a brownish substance; ovaries hard and firm, full of small cysts that contain a yellowish colored fluid; kidneys apparently normal.

CASE 16.—In my report on the investigations of Mr. H. B. Brown's stud c

during the first part of January, 1899, I stated that Mr. Brown saw the colt trying to serve a roan mare which he owned. This mare was examined on January 30, and at various times afterwards, as she was held under suspicion, but nothing was observed that would indicate that she was diseased until one day in February I noticed that she was suffering with a catarrhal condition having the appearance of ordinary distemper; but no doubt the inflammatory condition of the mucous membranes was the early inflammatory condition which occurs in the early stages of *maladie du coït*. The eyes discharge freely a thin watery mucus, and there was a heavy discharge of mucus from both nostrils. She remained in fair condition of flesh, notwithstanding she had been driven 3 miles and back every day during the winter. However, she had a sleepy, drowsy, and dull appearance, and a rather rough dry coat. The mare apparently recovered after a run of about three weeks, and nothing wrong was noticed in her until about the middle of March, when there commenced to appear on the fundus three small white spots. Two small ulcers developed on the rim of the anal opening, and one small white spot (not raw) came on the left side of the fundus on March 21. These conditions indicate to me very plainly that this case was just developing, as a result of attempted copulation with Mr. Brown's stud colt on April 6, 1898.

Post-mortem.—Roan mare, killed by shooting through the brain; carcass fairly well nourished; two white spots about one-half the size of a copper-cent piece on the left side of the fundus; numerous small white spots on the vulva that have just appeared during the past two weeks; vulva swollen and irregular; vagina contains considerable gelatinous yellowish substance. Upon opening the abdominal cavity about 10 gallons of straw-colored serum escaped; a well-developed fetus in the uterus; ovaries enlarged, and with several large cysts that contain a yellowish gelatinous substance, other cysts containing straw-colored serum. There were also several hard bodies of a bright yellow color in both ovaries; a small portion of the surface of each ovary broken down, apparently of the color of lean meat. A fibrous growth covered the greater portion of the superior surface of the liver; organ somewhat enlarged; both kidneys contain a large amount of yellowish gelatinous substance.

CASE 17.—One grade Clydesdale stallion owned by Matthew Wood; 13 years old, bright bay in color, thin in flesh, dirty and rough coat, appetite good, and as amorous as ever he was. On the morning that I examined him he teased a mare. His penis was badly affected, paraphimosis being very prominent. The organ was hanging out at full length and pendulent, paralysis being present. It was much swollen, having a deep ulcer-like ring around it at the preputial ring; prepuce very much swollen and covered with white spots; a number of raw ulcers on lower third of organ, also a number of scales that covered deep ulcers, which looked red when the scabs were removed; the glans penis very much enlarged and dark in color and partly covered with a yellowish sticky substance; a very profuse discharge from end of penis, the constant dripping covering the hind limbs; a very disagreeable and peculiar odor was emitted; two large white spots on the inferior surface of the scrotum; testicles hard to the touch and drawn up; small white spots, about half the size of a penny piece, in the skin between the buttocks; a small ring, due to the absence of pigment in the tissues, around the anal opening.

History.—The animal was not known to have been previously affected with *maladie du coït*. He was on the stand in Rushville until the last two years; during these two years he was on a farm 4 miles northwest of Rushville and used as a work horse. He served only a few mares for the neighbors during this time. About three weeks previous to my examination he was used to draw hay. He fretted considerably, warming himself up and sweating profusely. From this time he began to fail rapidly; appetite remained good, but he became extremely

poor; penis gradually came down and was swollen. The discharge continued till he was killed. He became a sight horrible to see, yet remained amorous and would tease mares to the last. Case diagnosed as *maladie du coït*, and the animal was destroyed by shooting in the brain.

Post-mortem.—The animal presented on post-mortem but very little more than has been described above. The tissue of the penis was soft and spongy when cut into; the walls of the urethra were covered with considerable yellowish watery discharge; testicles hard and drawn tight against the inguinal rings; lymphatic gland swollen; although the horse had a very large frame, weighing about 1,600 pounds when in good condition, the carcass was very much emaciated.

CASE 18.—Black mare with a crippled foot, showing signs of pregnancy; said to be due to foal April 20, but think it not possible to foal so soon. Examined her February 20, but since then the following symptoms have developed: Numerous white spots on the vulva and anus, ranging in size from that of a pea to a copper cent piece; very thin and poor; has rough, dry hair; was bred to Mr. Keethler's horse, here referred to as Case 9.

Post-mortem.—Black mare, destroyed by shooting through the head; carcass poorly nourished, thin and bony; anus, vulva, and perineum covered with white spots, giving a speckled appearance; mucous membrane of the vagina dark red in color, parts of the membrane nearly black; uterus contains large, well-developed fetus, which had a healthy appearance; uterus thickened and congested; right ovary somewhat enlarged and soft, containing several cysts filled with straw-colored fluid with large dark spot in center; left ovary normal in size and appearance; kidneys, liver, and spleen appear normal.

CASE 19.—A light gray mare owned by Mr. E. Ireland, who lives 10 miles southwest of Rushville. The mare was 4 years old; in fair condition of flesh; weight, about 1,000 pounds; was raised and always ran on the range southwest of Rushville, much of the time with Mr. Brown's stallion, referred to in this report as Case 2; got with foal last year on the prairie and dropped a "catch colt," which lived but three days. There were large white spots on the anus and numerous white spots on the vulva and on the skin by the side of the vulva. The white spots extended below the vulva on the perineum 2 inches. About one-third of the vulva would be white if the spots coalesced. Two white spots also on the lids of the right eye.

Post-mortem.—Besides the external appearances described above, there were the following: No milk in the udder; mucous membrane of the vagina congested and red; considerable brownish colored substance in the uterus; walls of the latter organ thickened and swollen; right ovary slightly enlarged and full of straw-colored cysts and several deposits of yellowish colored substance; left ovary appeared normal.

CASE 20.—A small bay mare, the property of W. C. Cook. She has black mane and tail; raised a colt last year and showing signs of pregnancy again; bred to Matthew Wood's horse (Case 17) on July 5, 1898. The following symptoms developed after that date: Two very large white spots on the side of the vulva; the vulva somewhat swollen and irregular in shape; thin in flesh; hair rough and dry.

Post-mortem.—Carcass thin, poor, and bony; not well nourished; besides the two large white spots on the vulva, the walls of the vagina light red in color over considerable portion of its surface, the mucous membrane changing in color to a dark purple over a part of the surface; uterus large and containing a large foal without any hair; considerable water in the abdominal cavity; right ovary normal in size, containing a dark, nearly black, center, several deposits of yellow substance, and one small cyst filled with straw-colored water; left ovary somewhat enlarged,

badly affected, several large cysts with straw-colored water in them, and numerous deposits of yellow material throughout; one large area and several small spots in the ovary degenerated and broken down, presenting a dark, dirty-looking substance, which emitted a bad odor.

CASE 21.—Property of William Hunter, who lives about 15 miles northwest of Rushville. Light gray mare, 8 years old; in fair condition of flesh; has numerous white spots on anus and vulva, extending down over the perineum to the mammary glands; the mare has a very peculiar gait, dragging both hind limbs when she walks, and scrapes her toes on the ground; ends of toes worn off considerably by the dragging. Although the animal has been in this condition only about two months, she is very irregular in her movements; she wavers from one side to the other in walking, and frequently knuckles over on her fetlock joints; when starting off rapidly she has a spasm-like movement, her hind limbs cramp and double up, which allow her hind parts to fall nearly to the ground. This condition has developed since my examination in February, 1899. The mare was purchased and destroyed by shooting through the brain.

Post-mortem.—Carcass well nourished; numerous white spots the size of a copper cent piece over the anus, vulva, and perineum; walls of the vagina dark red in color, somewhat congested, and covered with a dark brownish discharge; uterine small, walls thickened, and internally there was a coating of a dark brownish jelly-like substance; ovaries very much enlarged and badly diseased, about one-half the size of a man's fist, highly congested, having the appearance of beefsteak; entire substance of both ovaries broken down; the organs consisted of thin membranes highly congested and distended with bloody watery substance. Not having the necessary instruments at hand, I did not examine the brain or spinal cord for anything that might cause the peculiar and irregular action of the hind limbs that had been noticed.

CASE 22.—Dark-brown mare, property of Mrs. Sophie Brown, living about 6 miles southwest of Rushville; about 7 years old, in fair condition of flesh; has a large white spot on each side of the vulva. On the left side of the vulva only a small white spot appeared at first and also a considerable number of dark rough scales and scabs. When the scales and scabs were removed the skin beneath was chalk white, and there were a few depressions in the skin where a scab was removed. On the right side of the vulva there did not appear at first any depigmentation, only black rough scabs; when these were removed there appeared underneath chalk-white skin which covered about as much space as a silver 25-cent piece; five small white spots on the udder and one on the inside of the thigh.

History.—The mare was bred and raised on the range southwest of Rushville, from 5 to 8 miles distant, where she has been running with the H. B. Brown horses almost the entire season. In the month of August, 1898, the mare had a sick spell, as Mrs. Brown expressed it; the animal became stiff, especially in her hind quarters, weak across the back, and wavered from one side to the other when she stood or walked, and became very much emaciated. These symptoms disappeared and she got in very good condition again; showed signs of pregnancy. She was purchased and destroyed by shooting through the brain.

Post-mortem.—Carcass fairly well nourished. Besides the markings heretofore reported, the mare presented the following: Mucous membrane of the vagina dark red in color, with very dark-colored spots scattered over the surface; uterus contains a partially developed fetus; right ovary somewhat enlarged and containing numerous small deposits of a yellow substance, large dark spot, nearly black, in center, partly broken down; left ovary normal in size and apparently healthy; walls of the bladder somewhat thickened, mucous membrane dark red in color, showing some signs of past inflammation; kidneys, liver, and spleen apparently healthy.

CASE 23.—Examined 18 mares and 1 stallion at Hay Springs, Nebr., for Mr. Hugh Perkins. One of the mares was found to possess the characteristic symptoms of *maladie du coït*, which were as follows: Fine bay mare, 5 years old, black mane and tail, in good condition of flesh; purchased of Mr. Douglas Points, who lives 25 miles straight north of Hay Springs, in the fall of 1898, but was not delivered to Mr. Perkins until the spring of 1899. There were numerous large white spots on the fundus, so numerous about the anal opening as to give that part a white appearance; also numerous white spots on the vulva and along the sides of the vulva and on the perineum; the spots gave these parts also a white appearance; an abundant discharge from the vagina, which stuck to the tail and matted the hair, the discharge adhering to the thighs and legs down to the hocks; one white spot about the size of a green pea was located on the lower lid of the right eye. Was purchased and destroyed by shooting through the brain.

Post-mortem.—Entire left side was removed; vagina contained a small amount of brownish discharge, and mucous membrane dark red in color and congested; os uteri very much relaxed and loose, three fingers being inserted in the cervix at the same time; mare had been served, but no fetus in the uterus; mucous membrane of the uterus dark brown in color, highly congested, and somewhat corrugated; both ovaries enlarged to about three times their natural size, and when cut into about one-third of the organ was broken down into a dark-red substance resembling coagulated blood, but stronger in texture and more firm; the other two-thirds contained large cysts filled with dark bloody fluid; mesenteric lymphatic glands badly affected, enlarged and congested, easily broken down, and dark red in color; heart contained dark coagulated blood clot, left ventricle containing serum clot.

CASE 24.—One large stallion, 10 years old, belonging to Mr. Henry Henrichs, living 6 miles north of Gordon; mixed Clydesdale and Belgium breed, weighing about 1,600 pounds; has always been used for breeding purposes.

History.—The horse was owned and used for a number of years north of Rushville. Two years ago he was purchased by Mr. Henrichs and placed on the stand at his place and at Gordon. I examined him about a month ago, when he had a very copious discharge from eyes and nose. The manager of the horse said he had driven him in the rain about half a day, and during the exposure the horse contracted a cold. There was also noticed on the posterior side of the penis a raw ulcer about the size of a man's finger nail. This, the manager said, was due to cutting by the hair on the mare's tail during coition. Nothing more was thought about the animal until I was called to see him, as the owner said "he was in a bad fix." I learned that several of these ulcers had appeared from time to time, the first one appearing in the early spring. About the 1st of June there were two raw ulcers on the posterior part of the penis, and on June 3 there appeared, about 3 inches from the end of the penis, a boil. On June 6 he was led out to breed a mare. When he extended his penis it curved backward, nearly to his hind limbs. On June 10 the penis was protruding about one-half its length and was enormously swollen; foreskin very much swollen and thickened; sheath badly swollen, the first to swell, having commenced the day before; testicles rather tender to the touch, and very much irritated; the spermatic cords kept jerking them up alternately. The appetite remains good, the animal eating and drinking heartily. He is as amorous as ever he was. June 13 the penis and sheath greatly swollen, more than on the previous occasion; has commenced to swell along the abdomen for a distance of 12 inches; scrotum greatly swollen and testicles greatly irritated. Hot fomentations were applied to the swollen parts for several hours during two days, and boiled oats were also applied by a suspension under the swollen parts, but the swelling in the penis and scrotum remains about the same, the swelling

along the abdomen increasing. June 19 the animal was purchased and destroyed by shooting through the brain.

Post-mortem.—Besides the conditions heretofore reported there were the following: Large scales and scabs appeared on the penis; under the scabs were large white spots, dry and cicatrix-like in appearance; a yellowish substance had discharged from the penis during the animal's sickness, and the substance was found in the urethra when it was cut open; small scales on the sides of the sheath; when these scales were scratched off small white spots appeared; several small cysts containing purulent material were found along the urethra in the tissues; foreskin enormously thickened, also sheath and scrotum; testicles somewhat swollen, soft, and lax; lymphatic glands enormously swollen and highly congested and easily broken down.

CULTURE MEDIA FOR BIOCHEMIC INVESTIGATIONS.¹

By E. A. DE SCHWEINITZ, PH. D., M. D.,

Chief of Biochemic Division, Bureau of Animal Industry.

While endeavoring to isolate the soluble ferments of the hog cholera germ² I have had occasion to make use of an artificial medium recommended by Fermi for the study of the ferment-producing germs in general (*Archiv für Hygiene*, 1890, Vol. X, Part I, p. 1), containing to every 1,000 cubic centimeters distilled water 0.2 gram magnesium sulphate, 1 gram acid potassium phosphate, 10 grams ammonium phosphate, and 45 grams glycerine. In this solution the hog cholera germ grows well and characteristically. The idea was suggested by my assistant, Mr. James A. Emery, that this liquid might be conveniently substituted for beef broth in the preparation of agar or solid nutrient media. Some was accordingly made by adding to the above solution 1 per cent of agar and heating and filtering in the usual way. In this manner a clear, almost colorless, transparent medium was obtained, upon which the hog cholera and swine plague germs grow characteristically. It would probably be equally well adapted for many other germs.

As the convenience of substituting this solution of salts for beef broth was at once apparent, its adaptability for the cultivation of the bacillus of tuberculosis and bacillus of glanders was tried, and there have been in use in the Biochemic Laboratory for some time media prepared as follows:

For tuberculosis, the above-mentioned solution of salts, containing 7 per cent of glycerine and 1 per cent of peptone; and for solid media, this latter liquid without peptone plus 1 per cent of agar. Upon these media the growth of the germ is both rapid and characteristic—more rapid than upon an agar prepared from beef broth.

For the cultivation of the glanders bacillus the medium was prepared exactly in the same way as that for tuberculosis except that only 5 per cent glycerine was used instead of 7. The solution was allowed to remain slightly acid instead of being neutralized, and no peptone was added. The glanders bacillus multiplies both satisfactorily and rapidly.

¹Published in *New York Med. Journal*, Mar. 13, 1893. *Abst. Centrabl. Bakt. u. Par.*, 14, 1893, p. 330.

²*Philadelphia Medical News*, Oct. 1, 1892.

The solution of salts used for these media when first prepared is alkaline in reaction; by simply boiling, however, it can be rendered either neutral or acid, as some ammonia will be given off in boiling.

This method of preparing culture media, especially for biochemic work, where the products of the growth of the germ are the main points to be considered, has several advantages over the use of beef broth. It is always an easy matter to obtain the chemically pure salts, and, as the amount and character of the salts entering into the solution are known, it is less difficult to obtain and study the products which are actually the result of the growth of the germ. If the expense is to be considered, the medium prepared in this way is very much cheaper. I think this particular medium and media of this class will prove especially valuable in the study of bacterial products.

I hope to be able to report shortly upon the value and composition of a mallein and tuberculin derived from these artificial liquids.

In a later number of the New York Medical Journal of the same year I suggested the use of asparagin and the omission of peptone altogether from the media. Media so prepared has been used with satisfaction for a number of years, both in this Biochemic Laboratory and elsewhere, for various investigations.

A REPORT UPON AN EXAMINATION OF MILK.¹

By E. A. DE SCHWEINITZ, PH. D., M. D.,
Chief of Biochemic Division, Bureau of Animal Industry.

In December, 1897, a committee, consisting of Drs. S. S. Adams, G. M. Kober, and E. A. de Schweinitz, was appointed by the Medical Society of Washington, D. C., for the purpose of giving general supervision to a dairy and milk laboratory which the proprietor proposed to have conducted in accordance with the most modern requirements and the suggestions of this committee.

As a part of this inspection I undertook, with the assistance of Mr. Emery, a regular bacteriological, and in part chemical, examination of the milk furnished by this laboratory. It was decided at the outset that two kinds of milk should be supplied to the public—the one *pasteurized*, the other to be called *sanitary*; to be collected with every possible precaution, so that the dangers of contamination should be limited and the number of bacteria per cubic centimeter kept at a minimum. The company agreed to furnish me with samples of the milk twice each week. In addition to these, during October, November, and December, 1898, I had made daily examinations of the sanitary material obtained from a friend,² who received the milk as any other regular customer. The results in general of these examinations, as may be seen from the tables, have been satisfactory. They have shown very clearly the possibility of obtaining milk that contains a minimum number of bacteria per cubic centimeter, and have also demonstrated that carelessness in handling the milk increases the number very materially. The number of bacteria per cubic centimeter in the pasteurized milk has been found, as a rule, to be less than 200. In some cases no bacteria could be detected. In four instances the number of bacteria per cubic centimeter increased to over 5,000. A comparison with the number of bacteria in the sanitary milk on these same dates showed a very much larger number of germs

¹A report upon an examination of milk which was furnished by the Pasteur Milk Laboratory, of Washington, D. C., from January 1, 1898, to February 1, 1899. Presented to the Medical Society by Dr. de Schweinitz for the committee, and published in the *National Medical Review* for April, 1899.

²Samples marked G. M. R.

than should have been present if proper precautions had been used. In 135 samples of sanitary milk examined the number of colonies per cubic centimeter has in the majority of cases varied from 200 to 5,000. Three samples showed over 50,000 colonies per cubic centimeter; three others, over 20,000 and less than 50,000 colonies per cubic centimeter; one, over 15,000 and less than 20,000 per cubic centimeter; two others, over 10,000 and less than 15,000; two others, over 5,000 and less than 10,000. Since October, 1898, the percentage of fat has been fairly uniform over four samples. Before that date it was found often to be from two to three tenths below the amount guaranteed, namely, 4 per cent.

In April and May, 1898, I obtained through the health officer (Dr. Woodward), and in January, 1899, through one of the health office inspectors (Dr. Turner), samples of milk taken from 15 dairy wagons in the city. Thirty-two different samples of milk were examined. Of these, one showed only about 4,000 bacteria per cubic centimeter; one, 2,500 per cubic centimeter; five others, between 10,000 and 15,000; six, between 30,000 and 50,000 per cubic centimeter; and the remainder, more than 50,000 per cubic centimeter in several instances running over 115,000 per cubic centimeter. In those cases where the number of bacteria per cubic centimeter was small it is fair to presume that the milk was collected with considerable care. The other cases speak for themselves.

The danger of communicating disease by means of the milk supply has been reviewed so often and so thoroughly that it is not necessary to take up the question again. In a recent article Kanthack and Sladen reported the examination of milk supplied from different dairies to Cambridge, England. Nine of these different samples produced tuberculosis in guinea pigs.

When we consider, however, that in the milk supply of our large cities the number of bacteria per cubic centimeter has been found to vary from 30,000 to 85,000, and has often been found as high as the number of bacteria in the sewage of several towns—namely, between 1,000,000 and 4,000,000 per cubic centimeter—the value of the number of bacteria per cubic centimeter of milk as indicating the care which has been used in collecting and handling the milk is at once apparent. One of the German authorities (Bitter) on the subject of sanitary milk claims that the maximum limit for milk that is fit for food is 50,000 germs per cubic centimeter. On this basis the milk from only 13 out of 32 dairies that have been examined in this city would be fit for food. The results of the examinations which we have made show that it is possible to keep the bacterial content down below 50,000 per cubic centimeter, and it would not be expecting too much to demand that no milk should be sold if it was found to contain more than this number.

In a recent article in the British Medical Journal Dr. Nasmyth calls attention to the various laws in force in different countries in regard to the examination of milk. In Paris special authorization is required for cow houses, which are placed under the control of inspectors. Large dairies are included in the second class of offensive and dangerous trades. The dairies are subject to regulations. The walls must be faced with marble or tiled with cement. Examination of the milk is made by inspectors, who send samples of milk to the laboratories. Nocard states that animal tuberculosis is now rare in Paris, because the animals are not kept longer than a year before fattening and slaughtering.

In Stockholm, since 1886, the sale of milk can take place only in dairies where one room is especially set apart for this purpose, or in public places and markets under specially prescribed conditions. A written permission must be obtained from the bureau of hygiene before the milk shop can be opened. The places used for the sale of milk must be well lighted, well ventilated, conveniently arranged, and kept very clean. Such places must not be used until they have been approved by the health commission. They must on no account be used as sleeping rooms or kitchens, nor must anything be put in them which would infect the milk or give it a bad taste. The bureau of hygiene must be informed immediately if there is a contagious disease in the houses near the dairy. In such cases the sale of milk is stopped until the necessary precautions have been taken for preventing its spread.

Germany forbids the sale of milk from diseased cows. Milk stores must not be used as bedrooms or sick rooms, or be put in direct communication with them. Cow keepers must permit the examination of their cows by veterinary surgeons.

The sanitary laws of all Danish towns are good, but the milk inspection and the sanitation of the Danish villages are very poor.

In Berlin there are two large milk establishments conducted on a basis similar to that of the Copenhagen supply.

In Philadelphia the board of health requires the tuberculin test for dairy cows, and after sixty days' notice a milk producer who supplies the city and fails to furnish a clean bill of health, based on the results of the test, may have his milk rejected. Similar regulations are in force in New York. In New South Wales similar rules are also being enforced.

Under the English order of 1885 it was required that registration should follow inspection, and a report that the premises, the water supply, lighting, and ventilation were satisfactory. A pure water supply in abundance should be insisted upon, and it should be pointed out that cows grazing on lands manured with city manure may have their udders specifically infected, and that similar danger arises from

cows wading in ditches polluted by sewers. No dairy regulations can be considered sufficient which do not provide for the exclusion of tuberculous cows. Persons suffering from tuberculosis should not find employment in dairy work. It should be a penal offense for anyone to take a milk can or vessel from an infected room to a dairy or milk cart. The danger of creameries ought also to be considered, as the milk sent from an infected farm may be the means of spreading and widely scattering an epidemic. The use of sterilized milk ought to be encouraged. The larger the air space for the cows, the more light and sunshine, the cleaner the cows and stable are kept, the fewer are the microorganisms that gain access to the milk.

As would be expected, of course, the samples of pasteurized milk which we have examined contained a very much smaller number of bacteria than the sanitary, and in most cases where the pasteurization is properly carried out one should ordinarily find few or no bacteria. The very slight taste which may be imparted to the milk when this process is carried out is really unobjectionable, and after a very short time is practically not noticeable.

It is interesting to note that in some cases where the temperature (as recorded at the Weather Bureau in this city) was high, the number of bacteria found in the milk was still low; while in other cases, where the temperature was still lower, the number of bacteria found in the milk was higher than it should have been. The direction and velocity of the wind did not seem to be of any especial influence. Increasing the amount of dust in the air from the wind did not seem to have any marked effect upon the milk.

The average number of bacteria per cubic centimeter found in the samples of sanitary milk examined between January 1, 1898, and February 1, 1899, was 5,971. The average number of bacteria per cubic centimeter in the samples of pasteurized milk examined during the same time was 266. The total number of sanitary samples examined was 135. The total number of pasteurized samples examined was 74. The total number of samples examined from other dairies was 32, and the average number of bacteria per cubic centimeter in these was found to be over 61,886. In all these examinations agar plates were made and the colonies were counted after forty-eight hours. A study of the accompanying tables will emphasize some of the points to which reference has been made and call attention to other interesting facts which should be carefully considered where an effort is made to secure milk under the best possible conditions.

Table showing, for pasteurized and sanitary¹ milk, the number of colonies per cubic centimeter after forty-eight hours; plated on agar.

PASTEUR MILK LABORATORY.

Date.	Sanitary.	Pasteurized.	Date.	Sanitary.	Pasteurized.	Date.	Sanitary.	Pasteurized.
1898.			1898.			1898.		
Jan. 2.....	2,600	180	Apr. 6.....	5,040	72	Sept. 27.....	17,172	180
7.....	1,400	0	8.....	756	300	Oct. 7.....	3,312	33
9.....	500	60	14.....	324	14	11.....	3,240	216
10.....	1,500	20	18.....	2,592	0	14.....	9,504	5,112
11.....	100,000	0	20.....	4,032	36	18.....	13,248	168
12.....	3,000	114	21.....	24,120	0	25.....	2,448	864
13.....	504	144	26.....	1,800	252	28.....	3,132	576
14.....	573	72	29.....	4,320	36	Nov. 8.....	1,548	2,628
15.....	1,116	-----	May 2.....	612	0	11.....	1,656	-----
16.....	432	0	5.....	612	0	15.....	1,152	144
17.....	432	-----	9.....	216	0	18.....	-----	-----
19.....	972	36	13.....	2,304	0	25.....	32,644	-----
20.....	1,296	0	17.....	3,600	0	29.....	98,640	72
21.....	504	36	20.....	1,512	36	Dec. 2.....	1,980	324
22.....	144	0	24.....	3,708	36	6.....	3,780	72
23.....	36	-----	27.....	4,428	144	13.....	3,276	36
24.....	144	72	31.....	1,728	0	16.....	4,176	144
25.....	756	0	June 3.....	3,780	72	23.....	7,704	72
26.....	72	0	7.....	306	0	27.....	2,340	108
28.....	36	72	10.....	1,500	6	1899.		
Feb. 2.....	72	36	14.....	550	50	Jan. 6.....	4,272	72
7.....	288	0	July 8.....	2,448	0	10.....	3,132	-----
11.....	756	72	15.....	10,800	0	13.....	3,708	36
15.....	432	0	22.....	3,384	5,490	20.....	4,212	36
18.....	288	0	26.....	4,320	72	24.....	3,384	72
24.....	314	72	Aug. 23.....	27,036	72	31.....	4,752	72
Mar. 30.....	1,512	180	30.....	3,006	144			
Apr. 1.....	2,160	108	Sept. 13.....	1,800	504			

Date.	Sanitary G. M. R. ²	Date.	Sanitary G. M. R. ²	Date.	Sanitary G. M. R. ²
1898.		1898.		1898.	
Oct. 12.....	5,304	Nov. 3.....	2,736	Nov. 26.....	1,530
13.....	-----	4.....	2,340	28.....	7,416
14.....	12,474	5.....	9,900	30.....	42,444
15.....	10,908	7.....	252	Dec. 1.....	57,276
17.....	8,532	8.....	1,632	2.....	10,512
18.....	5,400	9.....	3,492	3.....	1,020
19.....	9,228	10.....	2,088	5.....	3,168
20.....	94,760	11.....	1,800	6.....	2,736
21.....	4,500	12.....	2,196	7.....	3,384
22.....	84,024	14.....	792	8.....	16,306
24.....	3,840	15.....	1,008	9.....	3,534
25.....	1,800	16.....	510	10.....	2,736
26.....	1,746	17.....	1,512	12.....	1,728
27.....	4,536	18.....	6,446	13.....	5,700
28.....	2,828	19.....	2,484	14.....	3,636
29.....	1,472	21.....	6,480	15.....	2,664
31.....	1,800	22.....	6,228	16.....	1,020
Nov. 1.....	1,008	23.....	3,816	17.....	5,652
2.....	22,680	25.....	10,764		

¹ See p. 147 for explanation.² Milk delivered through G. M. R. to laboratory.

Table showing, for pasteurized and sanitary¹ milk, the number of colonies per cubic centimeter after forty-eight hours; plated on agar—Continued.

SAMPLES THROUGH HEALTH DEPARTMENT FROM VARIOUS DAIRIES.

Date.	Milk.	Date.	Milk.	Date.	Milk.
1898.		1898.		1899.	
Apr. 18.....	35,109	May 20.....	100,000	Jan. 9.....	37,298
18.....	3,906	20.....	100,000	9.....	13,600
18.....	31,068	20.....	100,000	9.....	7,200
18.....	15,480	20.....	100,000	9.....	117,900
18.....	100,000	20.....	100,000	27.....	26,050
18.....	100,000	Dec. 21.....	64,800	27.....	125,000
18.....	11,880	21.....	6,228	27.....	46,548
18.....	33,940	1899.		28.....	2,592
May 20.....	100,000	Jan. 7.....	12,240	28.....	198,720
20.....	100,000	7.....	37,440	28.....	189,000
20.....	100,000	7.....	64,440	28.....	26,352

SEWER WATER.

Date.	Sewer water.
1898.	
Dec. 21.....	125,000

PASTEUR MILK LABORATORY.

Date.	Average.			Date.	Average.		
	Sani- tary.	Pasteur- ized.	Sanitary G. M. R.		Sani- tary.	Pasteur- ized.	Sanitary G. M. R.
1898.				1899.			
October.....			15,820	January.....	3,910	58	
November.....			6,063	January, 1898, to			
December.....			8,157	Jan. 31, 1899,			
Oct. 12 to Dec. 17,				inclusive.....	5,971	266	
inclusive.....			9,474	For 1898.....	6,138	281	

SAMPLES THROUGH HEALTH DEPARTMENT FROM VARIOUS DAIRIES.

Date.	Milk. aver- age.
1898.	
Apr. 18.....	47,433
May 20.....	100,000
Dec. 21.....	35,514
1899.	
January.....	64,598
Average.....	61,886

¹ See p. 147 for explanation.

Table showing, for pasteurized and sanitary¹ milk, the number of colonics per cubic centimeter after forty-eight hours; plated on agar—Continued.

PASTEUR MILK LABORATORY.

Sanitary.				Pasteurized.			
Highest.		Lowest.		Highest.		Lowest.	
Date.	Number.	Date.	Number.	Date.	Number.	Date.	Number.
1898.		1898.		1898.		1898.	
Jan. 11.....	100,000	Jan. 23.....	36	Jan. 2.....	180	Jan. 7.....	0
Feb. 11.....	756	Feb. 2.....	72	Feb. 11.....	72	Feb. 7.....	0
Mar. 30.....	1,512	Mar. 30.....	1,512	Mar. 30.....	180	Mar. 30.....	180
Apr. 21.....	24,120	Apr. 14.....	324	Apr. 8.....	360	Apr. 18.....	0
May 27.....	4,428	May 9.....	216	May 27.....	114	May 2.....	0
June 3.....	3,780	June 7.....	306	June 3.....	72	June 7.....	0
July 15.....	10,800	July 8.....	2,448	July 22.....	5,480	July 8.....	0
Aug. 23.....	27,036	Aug. 30.....	3,096	Aug. 30.....	144	Aug. 23.....	72
Sept. 27.....	17,172	Sept. 16.....	1,800	Sept. 16.....	504	Sept. 27.....	180
Oct. 18.....	13,218	Oct. 25.....	2,448	Oct. 14.....	5,112	Oct. 7.....	36
Nov. 29.....	98,640	Nov. 15.....	1,152	Nov. 8.....	2,628	Nov. 15.....	144
Dec. 23.....	7,704	Dec. 2.....	1,080	Dec. 2.....	324	Dec. 13.....	36
1898.....	100,000	1898.....	36	1898.....	5,480	1898.....	0
1899.		1899.		1899.		1899.	
Jan. 31.....	4,752	Jan. 10.....	3,132	Jan. 6.....	72	Jan. 13.....	36
Feb. 25.....	7,092	Feb. 28.....	3,240	Feb. 3.....	1,800	Feb. 28.....	36

PASTEUR MILK LABORATORY—SANITARY. G. M. R.

Highest.		Lowest.	
Date.	Number.	Date.	Number.
1898.		1898.	
October 20.....	94,760	October 29.....	1,472
November 30.....	42,444	November 7.....	252
December 1.....	57,276	December 3.....	1,620

¹ See p. 147 for explanation.

REPORT UPON EXPERIMENTAL EXPORTS OF BUTTER, 1898-99.

By HENRY E. ALVORD, C. E.,
Chief of Dairy Division, Bureau of Animal Industry.

The experimental exports of butter made during the year 1897 under the supervision of the Dairy Division, and already fully reported upon in the Report of the Bureau for 1898, were resumed in 1898 and continued into the year 1899. The work during this latter period was upon a much enlarged scale and under conditions more favorable to accomplishing the main objects in view, namely, establishing a good reputation in foreign markets for creamery butter from the United States and obtaining information of a reliable character likely to be useful to those who may hereafter wish to export butter upon a commercial basis.

The differences between the operations of the two seasons were as follows: In the first, nine shipments were made during the six months beginning with May and ending with October; in the second, sixty-eight shipments were made during the fifty-two weeks beginning April 30, 1898, and ending April 29, 1899. In the first a considerable variety of butter was included, from sixteen different creameries located in eleven different States, with the purpose of demonstrating that fine butter was obtainable in various and widely separated parts of the United States; in the second, fewer creameries were used, and after the season's operations were fairly established the supply was from only two. The object was to secure better commercial standing by furnishing parties with the same butter week after week. In the first the butter exported was well distributed in order that its quality might be seen by as many different merchants and others as possible—a kind of object lesson and advertising by sample; in the second the butter nearly all passed through but two channels of distribution, and most of the time only one, in order to continuously supply certain retail dealers and their regular lines of customers, and thus establish a definite status for the article in the trade of a selected locality. In the first, London was the only market experimented with; in the second, shipments were made to London, Liverpool, and Hamburg, and, more than all, to Manchester. The exports of the first season were confined to butter; those of the second included some cheese and three consignments of eggs.

It will thus be seen that the operations of the one season differed

essentially from those of the other, necessitating another full report. At the same time the report already published will serve for both seasons in several particulars and obviate the necessity of repetition in some matters of detail. For convenience of comparison and reference the same general order will be followed in this report as in that for the first season of experimental exports.

The following summary of the trials to be reported shows the extent of the operations: One hundred and thirty-seven different lots of butter were included in 68 separate shipments during fifty-two consecutive weeks and upon 30 different vessels; in all, about 153,000 pounds of butter in 2,711 packages.

The butter for the consignments of 1898-99 was obtained mainly in the same way as in the previous year—directly from the producing creameries—and upon the same general terms. Nearly all of it was made expressly for export under instructions from this office, based upon the experience of 1897 and modified by reports received from England as the season progressed. It will be interesting to note how the requirements of consumers in the north of England differ from those in and about London; also how much better butter sold which was thus specially prepared than the very best stock made for domestic trade and tried several times for the purpose of comparison. A list of the creameries from which butter was obtained, the number of lots, and the total in pounds furnished by each, will be found at page 200. Nine creameries in eight different States supplied butter during the period mentioned.

A special agent of the Department of Agriculture visited London, Liverpool, Manchester, Bristol, Hamburg, and Paris early in 1898 for the purpose of carefully studying the markets in those cities for butter, cheese, and other perishable farm products and making arrangements for the experimental exports of the season. This service was well performed by Mr. Newton B. Ashby, of Iowa, and several of his reports are appended to this report. They will be found to contain many useful and interesting facts in addition to those which are embodied herein. As the result of these preliminary inquiries it was decided to make no shipments to France and to try only a few to Germany.

In order to place American butter on sale in Paris it is first necessary to pay customs duties upon reaching France and then the octroi, or special toll, upon entering the city. The markets there found are not so good as those of Great Britain, which are free from these taxes and present just that much advantage. Again there is no refrigerated transportation available either to the ports of France or within that country. Further, it is almost the universal practice in France—and on the continent of Europe in general—to have all table butter freshly made and to use it without salt. There is consequently little demand for salted butter and that only at comparatively low prices. Under

these circumstances, it is apparently inexpedient to make even experimental exports of salted butter from the United States to Paris. For particulars as to dairy markets in Paris, see page 220.

The prospects in Germany were reported as very little better. There is, however, some demand for good salted butter at Hamburg, and a considerable shipping trade exists in the free port. The latter escapes the duties imposed upon merchandise which is landed in the city. Consequently it was thought advisable to make a few trials at Hamburg. It is unnecessary to include the results in the body of this report. They were unsatisfactory and discouraged repetition. The main facts are of some interest, and are given at page 223, of the Appendix, in connection with general comments upon the Hamburg market.

Great Britain continues to be by far the most attractive market for the surplus dairy products of the United States. That country has more than doubled its imports of butter within twelve years, as to both quantity and value. It now buys annually¹ about 182,000 tons of butter, at a cost of more than \$80,000,000. Every year the United Kingdom requires 10,000 tons of butter more than the year before to meet the steadily increasing demand. This is evidently the market for whatever butter the United States has to spare, always provided that it is good enough in quality to satisfy the British cousins.

Liverpool was reported as not particularly desirable for the proposed trials, excepting as to cheese, and Bristol as hardly yet having the necessary transportation facilities. London and Manchester were fixed upon as the markets to be persistently tested. These two were soon found to differ in important particulars. The conservatism and the prejudices of London are greater than in Manchester; it is the more difficult market in which to introduce a new article, especially by very sharp rivalry or attempts to displace another. Merchants and consumers could be found who were willing to buy a good article if sold cheap enough, but it was almost impossible to get them to express candid opinions, give reliable information of the nature desired, or make critical examinations of the States butter and fairly compare its actual merits with those of competing products. There were fortunately some exceptions, and one enterprising firm secured a number of written opinions from retailers which are quoted in later pages. At Manchester a more liberal spirit was found, and sales agents who appreciated better the purposes of this Department and cordially and intelligently cooperated to make the experimental exports accomplish the objects intended. This market also seems to be more discriminating as well as less prejudiced, and more regular in the purchase and consumption of butter. Accordingly, the shipments to London were stopped in November (1898) while those to

¹See Appendix V, p. 201.

Manchester were continued weekly until May, 1899. The latter resulted in the regular supply of a selected group of dealers continuously for a year, so that the butter from certain States creameries became well known, depended upon, and occupied a definite position in the Manchester market.

It is estimated that within a radius of 40 miles from Manchester there is a population of 8,000,000, nearly all of whom are nonproducers of food stuffs. Manchester is the distributing point from which this district is supplied with butter. The annual increase in the demand for butter within this district is said to be greater in proportion than that already mentioned for the whole nation. And the merchants of this city, in addition, furnish butter to other districts in the north of England, shipping direct from the ports of entry, without coming to Manchester. The butter trade represented by the Manchester merchants is therefore a very large one. The shipments of butter from Denmark and Sweden to the north of England are said to average 1,200 tons weekly. Of this, the territory known as the Manchester district takes about one-half. Seven-tenths of this quantity is of first quality, the rest being graded as "seconds" and "thirds." These facts show the opportunities afforded for introducing butter from the United States through Manchester as the center for distribution. A full review of the Manchester market is appended (p. 201).

In further explanation of the butter trade in England, the following letter is quoted from Messrs. Dowdall Brothers, butter merchants in the north of England:

MANCHESTER, *April 14, 1898.*

* * * * *

We will give you an account of how the trade in foreign butter is done with England. Generally speaking, all the butter made in Denmark and Sweden is by the use of the separator in creameries, where the farmers usually associate in groups, to suit their district and convenience. In short, the system may be termed cooperative dairying. This butter is shipped to England once a week. Usually each dairy brands its own butter with the name of the dairy. The bulk of the butter is of first quality. It is packed in casks, commonly called Kiels, and holding 112 pounds each. Most of the importing steamers are now fitted up with refrigerating chambers, which, however, are only necessary during the summer months. The remainder of the year is sufficiently cold to insure safe transit in the ordinary way. Most of those dairies have now found buyers who take them regularly every week, subject to the official quotation, which is fixed every week by a price committee sitting at Copenhagen. As nearly all this butter comes to England from Denmark, the price is, of course, affected by the state of the English market. We may mention incidentally that this official quotation governs the price of butter in the neighboring countries which produce it, and, of course, is also governed by them according to demand and supply. What we call the neighboring countries are Sweden, Norway, Finland, the Baltic provinces, Schleswig-Holstein, and parts of Holland, in all of which the separator is used. All of those countries are producing increasing quantities of butter, and the large surplus finds its way to England. Many of the Danish dairies sell their butter direct to the English importer, but the great bulk is shipped by Danish merchants, who have their business connections throughout the United Kingdom. A large quantity

of the butter comes from those countries on consignment to London or Manchester, and is there inspected and purchased by the buyers, principally retailers. The market price of butter in England depends first upon the supply of butter, and secondly upon the state of trade generally, which causes a more or less brisk demand, and is modified by the abundance (or otherwise) of other classes of provisions or fruits, and in a smaller degree by the state of the weather. Of course you understand that in cold weather there is a larger consumption of butter. In warm or hot weather consumers turn more to fruit, jams, fish, and light foods.

Speaking generally, and particularly for the north of England, Danish and Swedish butters (which practically rank equal) are most in favor. Within the past few years a very great extension of the use of the separator has taken place in Ireland, and the farmers have cooperated on the Danish plan to produce butter in central steam dairies. This butter largely competes with Danish, and realizes within a few shillings of the same price. One drawback to Irish dairying is that it ceases in winter, and the customers who are induced to buy the Irish goods during the Irish season, which is principally a seven to eight months' trade, are lost during the winter months, and there is always a difficulty in getting them back at the beginning of each new season. Very much lower rates have to be quoted to induce them to return to Irish goods.

We notice also within the past few years, not only a lower tendency in the price of butter during the whole year, but also that winter prices tend more and more in the direction of summer prices. This has been generally brought about by the introduction of Australian and New Zealand butters into the English markets during the winter months. Our winter months and period of dearth correspond with the summer months at the Antipodes, which is their flush time for make. During the past twelve months Canada has also made great strides in the direction of very good butter. They are shipping it in the 56-pound square or oblong box, which is much like the Australian package.

The Danes make butter in almost equal quantities the whole year through, winter as well as summer, and sending it fresh every week gives them a decided advantage in the market. The special characteristic of Danish butter is a beautiful nutty aroma, waxy texture, well made, and moderately salted, say 3 per cent. The interior of the casks are lined with parchment, saving any waste by the adhesion of butter to the timber. The Finnish butter is made on the same plan as the Danish, and treated generally in the same way, and to it this description applies. The Finnish casks are further bagged in coarse canvas, which brings them here in very good condition, perfectly clean. Being, however, on an average a week longer en route, Finnish butter does not bring within 5s. a hundredweight of the best Danish, and some qualities not within 10s. a hundredweight, as the slight additional freshness and succulency of the Danish easily obtains for it a preference.

In reference to water in butter, we may say English analysts look to 15 per cent as the maximum. Most of the Australian butter does not show an average of above 10 to 12 per cent of water. Danish butter averages 12 to 14 per cent. We herewith hand you a paper on the water-in-butter question by our Mr. J. B. Dowdall, accompanied by laboratory dairy trials at Copenhagen. This is the fullest information to date, and has not been superseded by anything since written of which we are aware.

There is a campaign opening against the use of boracic acid as a preservative. Some analysts condemn it entirely; others would allow an extremely small quantity. If one article alone, like butter, contained boracic acid or its derivatives as a preservative in safe quantities it might be allowed to pass, but so many articles now, such as milk, fish, poultry, bacon, and other foods, are preserved by this method, that the aggregate may be injurious to human health. It is also evident that the excessive use of boracic acid can easily destroy the fine flavor of butter.

The circumstances under which the experimental exports of 1898-99 were conducted made it possible to incidentally compare the merits of butter made from pasteurized cream with that from "raw," or non-pasteurized, cream, without disturbing the business aspects of these trials or the advantages derived therefrom. This comparison is presented at page 233. Conditions were not favorable for making further trials in exporting "sweet," or unsalted, butter, nor butter in small family packages.

The package in which it is best to send butter from the "States" in order to secure a favorable reception in British markets was further studied, but no new facts of importance were developed. The package finally adopted as most expedient was a modification of the "Australian" cubical box, the sides being made to spread out a little. A box of this shape which is $12\frac{1}{2}$ inches square at the top, $11\frac{3}{4}$ inches square at the bottom, and $12\frac{1}{2}$ inches deep, all inside measures, will hold just about 57 pounds of butter, well made and solidly packed. Spruce and poplar have been the woods used. Experienced makers and merchants in this country prefer a clear, well-seasoned spruce, as being free from odor and taste, but the English dealers objected to the "pine," insisted that it had both taste and odor, and therefore poplar was mainly used. It seems to be a fact that, however well seasoned the lumber and however harmless it may seem at the creamery, spruce develops an appreciable odor in its sea voyage to England, which is at once noted and objected to by merchants there, and which often imparts a more or less unpleasant flavor to the butter in packages of this material. The pattern giving the best satisfaction was worked out at an enterprising equipment factory and named "The Wisconsin butter box." The lumber used was one-half inch thick and the joints were matched with tongue and groove and held together with a small quarter-round in the upright angles outside and a few good nails. The cover had a rabbet around the lower edge and was held in place by six small brass screws with hemispherical heads. A further improvement will be simple clasps which fasten the cover tightly, but allow it to be easily removed and replaced. Boxes of this shape pack for transportation with more economy of space than tubs or pails, and have the advantage over perfect cubes or rectangular boxes of allowing the circulation of air all around the sides. The contents can be shaken out, or "stripped," as easily as from a creamery tub. This box costs 50 per cent more than the common cubical box or a 60-pound tub, but it is worth twice as much. It is strong, safe, neat, and attractive. There can be no more mistaken economy than sending good butter to a distant and critical market (or to any market) in a cheap unsatisfactory package.

The Wisconsin box was well received in Great Britain and commended by all who handled it. It may not have actually added to the price of the butter it carried, but it certainly helped to sell it. It

is a good package with which to introduce fine butter to a new market. But, as previously noted, if reputation can be won for a certain butter or line of butters, and dealers can be convinced that they are getting the butter wanted and as represented, British markets are not so prejudiced as to insist upon the box, or any particular package. Therefore it is believed that eventually it will be possible to send American butter to British buyers in the orthodox American creamery tub and suffer no loss by reason of using this package. It will certainly be very desirable to use, with satisfaction to all, the same package for home trade and for export.

With either boxes or tubs parchment paper linings must be considered as essential to success, and this in addition to a coating of paraffin, or some substitute, on the inside of the package. Here again it is true economy to use a good article. The linings for butter packages in general use in this country are much too light in weight, and thin and weak or poor in texture. A very much better lining can be got at a small additional expense. And the lining should be more liberally used as to quantity. For the Wisconsin box, triple linings have been used in these experimental exports. The first piece ran around the sides of the box, lapping on one side, and covered the four upright joints. The next piece lay across the bottom and up opposite sides, extending far enough to fold across the top and lap 2 inches. The third piece was like the second but laid in the opposite direction. The three pieces thus covered the inside of every joint in the box, including cover, and made two thicknesses of linings between the butter and the six interior faces of the package. Thus arranged, a cap or top cover was unnecessary, although a square of suitable size was generally used next to the butter. The linings as thus used, and of heavy and superior material, when bought in quantity cost just about 2 cents per box, as against 1 cent for the quantity and quality, both unsatisfactory, commonly used for the Australian box. The linings which are most in use in the United States are of the material known as "30-pound parchment." Some use the 40-pound quality for export boxes, but there is much more of this paper used which is lighter weight than 30 pounds than of any heavier grades. In Canada an 80-pound grade is used for box linings and the 100-pound quality is in demand in Australia and New Zealand. The 80-pound grade is strongly advised for use with butter intended for export from the United States, especially if it goes to Great Britain. Nothing lighter in weight than the 60-pound parchment should be considered. Merchants and consumers would welcome the use of heavier and consequently stronger and better grades of parchment for linings and wrappers all through the butter trade, domestic as well as foreign, and butter makers and creameries would share fully in the resulting advantages.

The use of coarse burlap sacks or covers for the boxes or tubs exported, at a cost of about 8 cents each, has been continued during



CASKS AND FIRKINS OF FOREIGN-MADE BUTTERS.

1



BOXES OF FOREIGN-MADE BUTTERS.





FOREIGN-MADE BUTTERS, SHOWING METHODS OF PACKING

the past season, and experience has confirmed all that was said in the previously published report in favor of this protection to the exterior of butter packages going to a distant market.

Small family packages of butter for delivery unbroken, and 1-pound and $\frac{1}{2}$ -pound bricks or prints, were tried again but still found to be regarded as an innovation. Buyers at London and Manchester do not yet want butter in these forms, even although every piece or package is closely wrapped and protected all the way from maker to consumer. The latter prefers to see the quantity desired cut from the big lump which stands on the retailer's counter for hours, exposed to dust, flies, and the impurities of air in city markets and all weather.

As already noted, it was found expedient to guard against claims for short weight, sure to come if net weights fell below the standard of 56 pounds to the package, by having the latter of a size to hold just about 57 pounds of butter. Instructions were given to put from $56\frac{3}{4}$ pounds to 57 pounds of butter into all boxes for the department. In order to test the average shrinkage, the contents of 200 boxes were carefully weighed at the creameries at time of packing, and at Manchester, England, when offered there for sale. The boxes were marked for identification and the weights reported and compared. These test weights were made at different seasons of the year. It was found that the average shrinkage in the net weight of butter in a 57-pound box between the creamery and the British market was very close to $8\frac{1}{2}$ ounces. In a few cases a small overweight was reported from Manchester, which could not be accounted for. With these exceptions the range of shrinkage was from 2 ounces to 1 pound 9 ounces per box; on 38 boxes the shrinkage was 1 pound or more, but in most cases it was only a few ounces. As was to be expected, the greatest shrinkage occurred in the summer months.

Samples of different lots of the butter exported were analyzed often enough for this office to keep closely informed as to the composition of the supply from the different creameries. The labor of analysis was cheerfully performed, as before, by the agricultural experiment stations of the respective States. This valued cooperation was appreciated and is hereby acknowledged. The butter was in nearly every case carefully examined and scored before being exported, and, through the enterprising assistance of the Manchester sales agents, several packages in most of the different lots sent to that market were critically inspected there upon arrival, scored upon the same scale used in New York, and fully reported upon. From nearly all the lots exported one or two sample packages were set apart in New York, placed in cold storage there, and these "check packages" were scored every ten days or two weeks to observe the deterioration caused by time. For purposes of comparison packages of the best

butter to be found in London and Manchester, from fifteen or twenty different countries or supply districts, were purchased, expeditiously and carefully sent to New York and then scored and analyzed. Tables giving the results of these scorings and analyses with interesting comparisons will be found on page 237 of this report.

No material changes were found in the facilities for railway transportation, as fully described in the previous report, from interior States to points of export, whether in refrigerator cars or otherwise. With all the care exercised by railway companies and fast-freight lines, it seems impossible to prevent occasional detentions and delays. In order to be reasonably certain of making shipments weekly from New York and Philadelphia, it is necessary to arrange for butter from points west of Chicago to arrive two or three days in advance of the times fixed for steamer sailings. This involves providing cold storage at the ports, and shipping agents to receive the goods on arrival by rail, promptly store them, and deliver them at the steamer at the proper time for loading. This additional labor and expense seems unavoidable to guard against accidents, delays, injurious exposures, and failures in the weekly shipments. During the period under consideration 132 different lots of butter were shipped to New York and Philadelphia. Of these, 20 were from points in Vermont and New York, most of them by express, and they all reached their destination on schedule time. The 112 lots remaining were from points west of Chicago. Of these, 86 arrived at the seaboard according to schedule, 16 were behind time one day, and 9 of them two days. Five lots were between three and five days overtime in transit, missed the steamer by which they should have gone forward, and had to be held over a week, unless some special arrangement was made to save a few days by shipping on a vessel not usually employed. These five unusual delays were with lots from four different points—two from Nebraska, and one each from Kansas, Iowa, and Minnesota. One of these cases was found to be due to circumstances which could not be guarded against; the others apparently occurred at points of transfer and might have been avoided. Such delays seriously disturb business; they involve extra expense, receivers fail to get their weekly supply, customers are disappointed, and the interests of shippers suffer. It thus appears that even with a regular margin of forty-eight to fifty hours between expected arrival by rail and sailing time, such failures to connect will sometimes occur.

The transportation rate on butter, by fast-freight refrigerator lines, Chicago to New York and Philadelphia, ranged during the season from 60 to 70 cents per 100 pounds. From points west to Chicago the rates were much higher and the service less efficient. It cost from \$1 to \$1.20 to get 100 pounds of butter from Kansas or Nebraska to Chicago, and this without refrigerator service all the way. Even from some places in Iowa the rate to Chicago was higher than from

that city to the seaboard. From central New York, expressage (without refrigeration) was also at a higher rate, and to move butter from Vermont to New York, also by express, without refrigeration, it cost 2 cents a pound, or more than the charge for better service from central Kansas. The prevailing rates from Wisconsin and Minnesota, with through refrigerator cars, were 1 cent and $1\frac{1}{2}$ cents, respectively. All of these rates are computed upon net weight of butter shipped in the form already described. The items incident to the detention and handling in New York, necessary to avoid missing steamer connections, averaged as follows per package of butter: Cartage from railway terminal to cold storage, 5 cents; storage, 30 days or less, 7 cents; cartage to steamer, 5 cents; total, 17 cents, or not quite one-third of a cent per pound.

The year 1898 was one full of embarrassment to the attempts to establish satisfactory lines of ocean transportation for perishable products, like butter, from Atlantic ports to Great Britain. Refrigerated compartments on ocean steamers were seldom open to the public, and the main reliance was to secure accommodations in the "beef boxes" through the courtesy of the fresh beef exporters having these in control. But in repeated instances arrangements of this sort had been made and barely put into operation when they were interrupted by the drafts made upon the merchant marine by the military necessities of the United States Government. The steamship lines had hardly got into regular running order again in 1899 when this series of experimental exports was suspended. During the period named shipments were made on thirty different vessels belonging to six different lines. The conditions were manifestly unfavorable for deducting conclusions, and it would be misleading to even quote the cost of this irregular ocean transportation, largely procured by favor. These disturbances and derangements resulted in compelling about one-third of the 68 shipments to be made as first-class ocean freight without refrigeration. These were during May and July, 1898, and from October, 1898, to April, 1899, inclusive. In most of these cases the steamship companies courteously gave the butter desirable position in the stowage, where the changes of temperature would not be great, and free from proximity to freight liable to impart odors. There were, however, no provisions for creating or maintaining an artificially low temperature. Although some of these shipments were during the coldest weather of the year, the British merchants frequently reported that the butter arrived in less satisfactory condition than when sent in the refrigerators with chilled dressed beef. Special inquiries and critical comparative examinations partially confirmed these reports. As a further test a shipment made in March and consisting of two lots of 20 boxes each was equally divided and one-half of each lot exported in refrigerator and the other half as open freight on the same steamer. In the two parts thus differently transported

the butter was practically the same at the time of leaving New York. The facilities for discharging the refrigerator were such that the butter which went in it reached Manchester one day in advance of the "open freight" lot. A very careful examination of both lots resulted in a report that there was no appreciable difference. Accepting this decision, the extra expense of refrigerated freight is useless during the winter months. After a careful review of this particular question, and comparison of the records at Manchester of several lots sent there in each way, the English merchants wrote:

Although the evidence in favor of refrigeration slightly preponderates, it is so slight that we think this protection might be discontinued and the butter sent as first-class or open freight. Formerly we thought that placing the packages in a beef box gave protection and secured their delivery in best condition. * * * Of course this refers to the winter months, and you would have to judge by the weather how soon to commence refrigeration again. In warm and sultry weather refrigeration along the whole line of transit is evidently necessary.

The excellent facilities for exporting butter enjoyed by Canadian shippers were referred to in the first report on experimental exports. As in 1897, the steamers from Montreal would carry States butter only when their space was not wholly required for the product of Canadian creameries and, when desired, telegraphic notices would be sent to intending shippers in this country four or five days before sailings as to whether or not their butter could be taken. Rates, as announced in May, 1898, were 30s. per ton from Montreal to Liverpool, London, Bristol, or Hamburg, and 32s. 6d. to Manchester. For carriage in cold-storage chamber there was an additional charge of 10s. per ton on Canadian butter and double this amount on butter from the United States. There are ample facilities at Montreal for cold storage of shipments awaiting exportation, and rates in 1898 were as follows: 12½ cents per hundred pounds butter net; 5 cents per package if less than one week. Through shipments not making close connections are delivered to the cold-storage company by the railway company, but an additional charge of 2 to 2½ cents per 100 pounds is made when the butter is forwarded from the stores. Cheese is held for 2 cents per box the first week and 1 cent thereafter.

The service of English railways, and by the delivery trucks or vans in London and Manchester, was fairly satisfactory and seemed to be improved over the year before. This refers to transfers and forwarding to London from Southampton and from the steamer landings on the Thames, and to Manchester from Liverpool; also to deliveries to the consignees at their warehouses.

The remarks made as to transportation of export butter in general, in the Report of the Bureau for 1897 (p. 93), were confirmed by the experience of 1898-99, and may be repeated, as follows:

If the transportation facilities were as good all the way from the American creamery to the European market as those afforded by the railroad lines in the

United States and the trans-Atlantic steamers (when their refrigerators are available), the journey might be even longer and slower without injury to butter exported over this route. The chief danger or damage arises from the delays, exposure, and changes of temperature incident to the transfers on railways and those from land to water and water to land again. For perfecting this service attention should be directed to reducing the number of these transfers and improving the conditions pertaining to those which are unavoidable.

It has been already explained that all the butter sent to Great Britain during the twelve consecutive months covered by this report was consigned to wholesale merchants doing large business in London and Manchester, and by these distributed to retail dealers among their regular customers. Instructions were given to endeavor to get the same retailers to take the States butter week after week, and this was accomplished fairly well, particularly at Manchester. The consignees or sales agents for the Department took pains to make the butter known and to sell it upon its merits. Every package was plainly marked: "Selected Creamery Butter—Produce of the United States." It also had an identifying mark to use in tracing and reports, but the creamery and State where made were not known to the retailer. At both markets the retail dealers hesitated about taking this butter at first, it being a new thing, and they could only be induced to purchase by making the price somewhat lower than butters with which they were well acquainted and which they regarded as of like grade. This prejudice was much stronger in London and was more slowly modified than in Manchester.

At the latter market dealers very soon acknowledged the merits of the article and some became anxious to get it regularly. As time passed they were willing to pay more and more for it, as compared with other butters of the same grade, but they were never ready to pay quite as much as for the best Danish butter. They argued that the latter was a standard article, uniform in quality and sure to satisfy their customers; hence there was no object in taking a new article instead of the Danish unless it afforded the retailer a greater margin of profit. If they could see inducement enough in the price of States butter, they were ready to buy it. Efforts were made to ascertain just how this butter was sold to consumers, under what name, and at what price; also to get candid opinions from consumers as to the merits of the butter. The results were very meager and unsatisfactory. There were difficulties in the way of obtaining much of the information desired which could not be overcome. To successfully introduce a new commodity in a conservative market it is necessary to work through the wholesale trade, unless the alternative is adopted of keeping a special sales agent always on the ground to peddle out the wares to such retailers as he can induce to take them. Wholesalers are naturally indisposed to tell who their customers are; this is part of their capital. English butter merchants have had unpleasant experience in this line, as the Danes have succeeded in many cases in sup-

planting the wholesalers and dealing directly with retailers, delivering even small quantities directly to the latter from the importing vessels. There is also a disinclination on the part of retail dealers either to give decided opinions of their own as to the comparative merits of different butters which they handle or to ask the opinions of the consumers. They hold that closely questioning customers is prejudicial to their trade and to the goods subject to inquiry. It suggests close criticism and encourages fault-finding. If butter is satisfactory to customers the latter will not complain, and if a new article can be served to them a few times without comment and they like it they will very soon begin to ask for this particular kind. Enough was learned, however, to show that very few of the purchasing consumers were informed that they were getting butter from the United States, and none of them, so far as known, got the benefit of the lower price paid for it by the dealers. As a general thing throughout the year of the experiments the consumers bought the States butter, supposing it to be Dorset (best English) or Danish, and paid the highest retail market price for it, and were entirely satisfied to do this week after week.

The Manchester market was found to be more liberal in its reception and absorption of a new article than the London market; and, while the former showed more discrimination as a buyer of butter and paid relatively better prices, it was at the same time much less disposed than the latter to find fault and make all sorts of trivial criticisms. For experimental purposes Manchester was much the better field, because we found merchants there more willing to give time and attention to States products and desirous of learning the use of the score card and making critical, comparative examinations of butters from various sources. These two markets are just about equally accessible via Liverpool and Southampton, respectively. The time required for transportation from New York by these two routes and the facilities for transfer and forwarding from the two ports named and for delivery to mercantile houses in the two terminal cities are very much alike.

The details of practice in unloading American butter upon arrival at different English ports and conveying it to the warehouses of distributing merchants are not without interest. The following accounts have been compiled from special reports made to this office:

One of the quickest routes to London is by steamer from New York to Southampton and thence by rail. When vessels of the American Line from New York reach Southampton, which they usually do on the sixth day out, they are docked within 50 feet of the immense freight sheds owned by this company, nearly 800 feet long and 150 wide. There is a sloping floor from the coping of the dock at the side of the steamer toward the opposite side of the sheds, and there cars can be run in and loaded or unloaded under the sheds on a level with

the upper part of this floor. Hydraulic cranes lift the freight in single packages or in "baskets" or boxes and deliver it on the dock at the side of the sheds. There are also arrangements for the cranes to deposit particularly heavy pieces directly upon the railway cars. At one end of the sheds the American Line has a cold-store room, fitted with all modern appliances, and having a capacity of 300 tons. This is available and free for all the perishable freight of this line which is necessarily detained at Southampton. Should butter be held there at the wish of the shipper, a charge is made of 2 pence per week per package, which includes all handling incident to the cold storage.

The usual plan is to convey perishables across the dock and deliver at once to the cars under the sheds. The Southwestern Railroad is the connecting line. This transfer is made after dark, and the freight train makes the run to London during the night. Four hours is the usual running time, so the butter arrives in the city before sunrise and may be delivered to the warehouses during the cool of the morning. Ordinarily shipments of this kind are made by the railroad in clean, well-ventilated freight cars, without refrigeration. In extremely hot weather there are plenty of refrigerator cars available. Should unusual detention occur, for which the railroad company is responsible, it has a number of masonry vaults available for storage under its sheds. These vaults are of about 40 cubic feet each, are lined with brick tiles, are cool, sweet, and clean, and, although not refrigerated, they are ventilated with electric fans, and would keep butter in good condition for days, unless exceptionally hot weather should occur, such as is very rare in England.

The regular freight rates from Southampton to London are 17 shillings per single ton, 16 shillings in 2-ton lots, and 15 shillings for 3 tons or more. The charge is the same for refrigerator cars, when used, but the shipper must furnish his own ice. The charge stated includes receiving from steamer, loading on cars, unloading at Nine Elms Station (which is the London terminal of this line for freight of this class), and also delivery from this station to any store or warehouse within reasonable distance. Delivery to the consignee by van or dray at the expense of the railroad is the custom in London, and this service is promptly and well performed. But for small lots of freight, 500 pounds or less, the corresponding charge is 18 shillings, and this does not include handling and city delivery.

If one has occasion to use cold storage in London the ordinary charges for butter are 20 shillings per gross ton for the first twenty-eight days and 15 shillings for every like period thereafter. The custom is to store butter at a temperature of 18° to 20° F., in which it is frozen hard if held for any length of time, and, in the opinion of many, this is very deleterious to the quality of this article.

Another and all-water route to London, avoiding transfers and railway carriage, is by the Atlantic Transport Line from New York or

Brooklyn. Two shipments of butter sent by this line were reported upon as follows (both were in refrigerators otherwise filled with dressed beef upon the S. S. *Mohawk* and S. S. *Mobile*, which sailed from New York, respectively, on the 28th of May and 4th of June):

LONDON, June 20, 1898.

The boats of the Atlantic Transport Line are due in the river Thames on the second Thursday after leaving New York. If they arrive in time to be moored at the wharf at high tide of Thursday, the agents of the beef company open the meat box that night in order to get beef for Friday's market. If too late for this, little or none of the meat is removed from the vessels until Sunday night. Consequently butter in these beef boxes may not be available for delivery until the Monday or Tuesday morning following arrival of vessel. In the first shipment by this line the butter was delivered on Tuesday morning, June 14; the second on Monday, June 20. These were, respectively, the eighteenth and seventeenth days after being loaded at New York. For the London butter market an arrival on Monday is far better than Friday.

The details as to unloading and delivering the butter for these two shipments were practically the same. In one case, when I reached the steamer, the refrigerators had been open for some hours. Upon being admitted to the room in which our butter was I found it had a clean, sweet smell with no suggestion of taint. The cooling pipes overhead were still frosted and everything in the room was dry. To remove the butter the boxes were placed in slings at the bottom of the well-hole and lifted by a steam derrick to the quay. Three loads sufficed for the 40 boxes, or one net ton of butter. This method of unloading is speedy, gentle, and safe. The packages were received on a raised platform on the wharf on a level with the bottoms of the vans or drays; the boxes were then loaded onto the drays by hand. I found a few of the boxes damaged—one absolutely broken—but know this did not occur in unloading, and believe it to have been done before the packages were placed on the steamer. The butter was put onto the fore part of an open van, the rest of the load being quarters of beef. Leaving the ship about 6 o'clock in the evening all was on the van half an hour later, having meanwhile been weighed and passed the customs inspection. The van left the wharf shed before 7 o'clock. The distance to Smithfield market is about 8 miles, and the vans are allowed three hours for the trip. Before starting a canvas meat cloth was spread over the load and a tarpaulin placed over this. As the van thus reached London as late as 10 o'clock at night, the vehicle was driven under cover and left until morning. The butter was then delivered at the warehouse of the butter merchant between 7 and 8 o'clock.

Instead of this long journey by dray, some merchants prefer to take their goods from the steamers onto barges and have these towed up the river to the business center. For large quantities this is cheaper, but it takes considerably more time and the exposure to inclement weather and changes of temperature, is very much greater.

To reach the market of Manchester, the best route is by steamer from New York or Philadelphia to Liverpool and thence by rail. An experimental shipment of butter and eggs by this route, in the "beef box" of the S. S. *Waesland*, which sailed from Philadelphia, April 30, was reported upon as follows:

The *Waesland* reached the Mersey on the evening of the 12th [May], too late to come into dock. The vessel was docked at daylight the next morning and securely moored by 5 o'clock. The agents of the beef company had notified me that they wanted meat for the Liverpool market of the 13th and would open their ship

refrigerators as early as possible. I was promptly on hand, although the Langton dock, where the American Line discharges freight, is 3 miles up the river and rather more than that from the center of the city. The cold storage rooms for beef lay on the two sides of the vessel, aft of the central hatch and directly below the second deck; the doors were on the aft side of the hatchway opening. The hatch or wellhole was filled with freight, and it was nearly 6 o'clock before the door of the first beef box was opened. The compartment had a nice, clean, sweet smell and the temperature was within a degree or two of freezing. The consignees' agents stated that they had never received a lot of beef in better order. Our goods were well back in the compartment and had to wait until the meat required for the day's market had been removed and a passage made into the chamber. This room contained 800 quarters of beef, all in cloths—cured hams, pork tenderloins and ox tails, in boxes—and lard in pails. Our shipment was on the starboard side of the ship, the butter packages resting against the wall of the hatch hole; the eggs came next, and in front were pails of lard. I went in as soon as I could, which was nearly 10 o'clock a. m., and examined the goods before they were moved. Everything seemed in good condition, dry and clean. The air was sweet and wholesome. The cooling pipes were coated with frost and the coverings on the meat were dry; where any moisture had been there was frost. Our goods were then carried to the hatchway, placed in a large sling of cordage and in this lifted from the vessel by a crane and deposited on the wharf. The handling was done with such care that articles more fragile even than the eggs would have been quite safe. From the slings the packages were carried by hand, singly, to barrows, and at once wheeled to the shed scales, where they were carefully weighed and examined by the revenue officials. The latter opened one of each of the different styles of packages in the shipment.

I may remark here that this customs examination is done very hurriedly and the officials are impatient if packages are not easily opened. Nails are preferred to screws for fastening covers, and the nails should be as few as possible and easily drawn by a lever under the cover, without splitting the latter. When fastened with screws covers are often knocked off and broken; the package must then go to its destination without cover or with only fragments tacked on. Some simple lock or catch device for the covers of butter boxes and egg crates, in place of all nails and screws, is extremely desirable.

At 10.25 o'clock the last parcel was on the wharf, and all having been rapidly weighed and passed the customs, they were wheeled in barrows to a lurry, or dray, and at 10.45 left the dock. Ten minutes later they reached the freight sheds of the Lancashire and Yorkshire Railway and were at once transferred by hand from the lurry to the railway van or car. Before 11 o'clock all were in the car. The lurry, or transfer dray, was an uncovered vehicle, but the weather was cool and cloudy, so that on this occasion there was no exposure. When protection is necessary from rain or sun, it is customary to cover the loads with paulins. No protection is possible, however, during the brief transfer from vessel to wharf and thence to the scales and the lurry.

In this particular case a railway car had been reserved for our use and contained nothing else. The train was due to leave Liverpool for Manchester at 11.30 a. m., so that the connection made with the unloading steamer was very close. It is probable that had not this part of the movement been given personal attention the butter would have been delayed till a later train and would not have reached Manchester that day. The train was a fast freight, due in Manchester (30 miles distant) at 2.30 p. m.

The railway company, by agreement, pays all dock and customs charges at Liverpool, and includes the same in its bill on delivery, so that one payment covers all charges between the ship's hold and the

merchants' warehouse at Manchester. The items of these charges on butter are as follows:

	s	d
Landing charges, per ton, gross.....	1	7 or \$0.39
Attendance, per ton, gross.....	1	0 or .24
Customs fees, ¹ per ton, net.....	2	6 or .61
Drayage, Liverpool, per ton, gross.....	1	3 or .30
Freight to Manchester, per ton.....	9	2 or 2.23
Drayage, Manchester, per ton.....	1	9 or .43
Total charges, per ton.....	17	3 or 4.20

Leaving Liverpool by passenger train at 4 p. m., I arrived at Manchester in one hour, and going direct to the warehouse found the goods being there unloaded from the railway lorry. This warehouse is fairly ventilated, and not greatly affected by outside temperature at this season. I hung a thermometer, and the next morning found the temperature was 50° F. in the house at opening hour; later it rose to 52°, and during market hours, while gas jets were burning, it went up to 54°. The butter stood in this warehouse, under these conditions, from Friday afternoon (May 13), until 10 o'clock on Tuesday morning, the 17th.

By way of comparison, there follows the report of the same agent upon a shipment sent a few weeks later, as first-class freight without refrigerating, on the *S. S. Majestic*, of the White Star Line. This vessel cleared from New York on the 18th of May. She was due at Liverpool on the 25th, but did not arrive till night; she reached her moorings at the Canada dock, and began to discharge her cargo at 7 a. m. on Thursday, 26th:

The Department consignment of butter was in the ship's store No. 2. This is not, properly speaking, even a cold store, and while I had no means of taking temperature of the compartment when opened it must have been about 40° F. The compartment was full of butter from America, in square packages, tubs, and casks. These seemed to be of two brands, both marked "Creamery," and one of them "Kangaroo." They were evidently consigned to a Liverpool firm. Our lot was back of the entrance and forward against the walls of the ice box. It was not all together, but a part was separated from the rest by butter in tubs and half kegs. The compartment was opened at about 9.20 o'clock, and, while there was not that cool, sweet, and cleanly odor that was characteristic of the beef refrigerator room on *S. S. Waesland*, there were no offensive smells, but something of a close, stuffy atmosphere. Our butter was reached about 10.20 o'clock and was soon on dock. The unloading of the *Majestic* is pushed with more dispatch than that of the *Waesland*, and freight is handled a little more vigorously yet not so roughly as to endanger a butter package if fairly well made. Freights were made to slide down an incline plane from deck to dock. Our goods were consigned to Manchester by the White Star Company over the Lancashire and Yorkshire Railway, and this company had its dray in waiting, and immediately goods passed customs they were carried to the freight station just across street from the dock, put from dray onto car, and were dispatched by their 11.30 a. m. fast freight to Manchester; there they arrived in time to be delivered at the warehouse at 3 o'clock p. m.

The consignment marked "B" and not covered with canvas came through fairly cleanly, and will probably bring as much money as if canvas covered, so far as appearance of package has influence; but I would recommend covering

¹ This fee for entry is upon every shipment regardless of quantity.

with canvas for summer shipments especially, not only on account of greater cleanliness but also for reason that the cover is worth its cost and more as protection from high temperature.

I arrived from Liverpool at 3 p. m. and found goods being transferred from dray to warehouse. (I may add that had I not been present in Liverpool the goods would not have reached Manchester until morning, as they would not have been taken from ship in time for 11.30 freight.)

Later reports called attention to the fact that unless favorably placed on shipboard for early discharge (whether in refrigerator or not) butter was liable to be landed at Liverpool so late as to miss midday or early afternoon trains to Manchester. In such cases butter remained on the cars from afternoon of one day until early business hours of the next. For this reason shipment from Liverpool by the London and Northwestern Railway was preferred, because that company supplied refrigerator cars, while the Lancashire and Yorkshire Railway has no refrigerator accommodations.

Shipments directly to Manchester, avoiding transfer and railway, may be made by vessels using the ship canal from Liverpool to Manchester. During the year 1898, however, there were no fixed and regular sailings from United States ports over this route, with the exception of one line from New York. That line made weekly departures, but the vessels were slow, occupying a fortnight for the passage and they had no cold storage or suitable provisions for perishable freight. The accommodations for 1899 have been little better. But arrangements have been made to extend to Manchester an excellent steamer service existing between Montreal and Liverpool and which is well equipped with modern commercial refrigerators. This line offers special inducements to shippers from Chicago and from points northwest of that city. The Manchester Ship Canal Company are alive to the interests of this new enterprise and have plans which, when perfected, will make the service from New York and Montreal direct to Manchester as favorable in time, rates, and accommodations as that now terminating at Liverpool.

Another ocean route for reaching both London and Manchester, and which is expected to soon offer facilities which will make it popular, is that which makes Bristol its eastern port. This city lies 118 miles west of London and upon the Avon River, 7 miles from where that stream empties into the Bristol Channel. The real port is Avonmouth, at the junction of river and channel, although ships of light burden can go up to the Bristol docks on high tide. The dock and shed facilities at Avonmouth are excellent, including ample cold storage. Two trunk line railways connect Bristol and its port with all sections of England. The Great Western furnishes direct and excellent service to London. Perishable freight received by this company at Avonmouth before 6 o'clock in the evening is at London the next morning in time for early delivery. Refrigerator cars are available when needed, but are not often used. The Midland Railway

gave satisfactory service to the north of England, although less direct, and the journey to Manchester is quite long.

The Dominion Line of steamers, better known as the Elder-Dempster Line, gave the Department most satisfactory service between Montreal and Avonmouth. The sailings average three per fortnight, and some of the vessels are equipped with fine refrigerators. The rate on butter from Montreal to Bristol, in refrigerator, has lately been 35 to 40 shillings per ton, or less than half a cent a pound. The through rate, Montreal to London, has ranged from 45 to 55 shillings per ton. The time is about ten days. Messrs. Elder, Dempster & Co. have already established a branch of their line to make direct sailings fortnightly between Boston and Bristol. Fourteen-day boats are used on this route, with no refrigerators, but the company is intending to develop this branch and improve it in all respects.

Besides its advantages as a port of entry, Bristol offers a pretty good butter market of its own. This received the attention of Mr. Ashby, and his report is appended at page 210.

A comparison of the markets for good butter in Great Britain and in the United States shows that during the period covered by this report there was no commercial inducement to export much butter from this country. A very careful study has been made of the data available for this comparison, and the selections made require no explanation or justification. Choice Danish in London, as quoted by experienced and responsible merchants, represents the British basis for comparison, and extra creamery in New York, quoted by accepted authority, is the basis for this country. To the tables of these quotations (see p. 216) such figures have been added as could be depended upon, giving the market value of States butter in London. All quotations are those of wholesale prices.

The year 1898 opened with Danish butter worth 25 cents per pound in London, but the market had fallen to 21 cents and was still declining at the time the season's experimental exports from New York began. The price remained at about 20 cents through May, June, and July, dropping almost to 19 at times, and then rose quite rapidly, averaging 21 cents in August, 24 in September, 25 in October and November, and reaching 27 cents in December. The extremes for the year were 19 cents in July and 27½ in December, with an annual average of 23 cents. During the first three months of 1899 a price of 24 to 25 cents was maintained, and in April came a sharp decline to 21 cents. In New York creamery, extras began the year 1898 at 22 cents, but quickly dropped to 20 and held close to that level till April. In that month there was a transient rise above 21, followed by a decline to 17. This level was held, with temporary depressions to 15 cents, until the middle of July. Then there was a gradual rise, 21 cents being reached by the 1st of October. The average for November was above 23 cents, and 21 for December. The extremes for the

year were 15 cents in May and $23\frac{1}{2}$ cents in November, with an annual average of $19\frac{1}{2}$ cents. The first three months of 1899 were marked by unusual fluctuations. Beginning at 21 cents, the price dropped to 19 before the end of January, and then suddenly rose to 25 in February, immediately declining again to an average of 21 for March. In April there was a further and continuous decline to 17 cents at the time the trial exports ceased. Comparing the extremes and the average, it looks at first sight as if there was a margin of $3\frac{1}{2}$ to 4 cents a pound right through the year between the value of creamery butter in New York and what Danish commanded in London. If so, it would seem as if profitable exports might have been continuously made. But closer examination shows that the changes in the two markets did not run parallel. At times during the year—in April, July, August, and November—the London quotation was but 1 cent above that of New York. Further, as already fully explained, the best American butter could not, by merely being offered in Great Britain, command a price equal to the Danish. The London quotations of States butter, so far as made (perhaps not the best, but of creamery grade), were at no time more than $2\frac{1}{2}$ cents per pound above the New York figures given, and most of the time the two were much closer. In seven different months butter from the United States was quoted in London at a market price less than extra creamery sold for at the same time in New York. Manifestly there was insufficient inducement for commercial exports in any quantity or for any length of time during the year 1898. There were certain brief periods when the difference between the two markets was such that if prompt action had been taken on cable advices butter could have been sent from New York and sold at a profit in England. This was actually done, but to a very limited extent with butter of good grade. And prompt and advantageous sales were necessary to success, for conditions favorable to such transactions were not continuous throughout any whole month in the year. These facts and relations as to the butter markets of New York and London are shown graphically in a diagram at page 217.

The experimental exports were thus made under adverse commercial conditions, resulting in more or less loss. To offset this pecuniary loss the information obtained was credited, and this was the prime motive throughout the transactions. There were several reasons why the balance against these exports was greater than would have been the case if the shipments had been made upon strictly commercial conditions. In the first place, although the butter bought by the Department for these trials was graded in New York as "extras" and in England had to be placed in the general and rather indefinite class of States creameries, it was in fact selected from factories with reputation enabling them to command prices "above the market." Therefore the first cost of the butter was high, averaging rather above ruling

rates. But it was manifestly the right thing to get the best butter available, even at this extra cost. Then the quantities of butter handled were so small, as compared with usual commercial transactions of this kind, that the incidental expenses of all sorts, when distributed, made the charges per pound unduly large. At the other end of the account, the butter had to be sold at prices below its acknowledged merits simply because it was new to the British markets, and with abundant supplies of better-known goods, merchants would not take the States butter at all unless the price was placed so as to be an inducement.

The purchases for these shipments extended through twelve consecutive months—from April, 1898, to April, 1899. The price at the creameries, with transportation to New York added, ranged from 15 cents, paid for Iowa butter in May, to 25½ cents, paid for New York butter in October. The average cost per pound for the whole 160,000 pounds of butter was 20½ cents. The sales made in London and Manchester ranged from 15½ cents in May to 24 cents in November, the average for the year being about 21 cents. Therefore, while the butter sold all along, with the exception of a few damaged lots, for more than it cost at New York, it was not enough more to pay the expenses of ocean transportation and sales. It is more instructive to quote certain selected records. Butter from two excellent creameries, marked L and N, was sent to Manchester every week from the 1st of July until the end of April, with the results following:

Mark.	From—	Cost at New York, per pound.			Sale price at Man- chester, per pound.			Totals.	
		Mini- mum.	Maxi- mum.	Aver- age.	Mini- mum.	Maxi- mum.	Aver- age.	Cost.	Pro- ceeds.
L.....	Minnesota	Cents. 17.8	Cents. 24.0	Cents. 20.9	Cents. 18.5	Cents. 24.1	Cents. 22.8	\$9,128	\$9,518
N.....	Wisconsin	17.0	23.0	20.7	17.3	24.0	21.8	9,687	10,230

These figures show more favorable results. If this butter had been moved from the place of manufacture in carload lots and on through freight rates obtainable for such quantities, the net receipts in England would have given the creameries a profit over the best home markets. Four different creameries, located in Iowa, New York, Minnesota, and Wisconsin, supplied an aggregate of 135,000 pounds of butter, which was sold in London and Manchester during the season mentioned. This butter at the time it reached New York cost \$20.52 per hundred pounds on an average, and sold at an average of \$21.22; the total cost (New York) was \$27,923.87 and the net proceeds \$28,621.23.

The returns from certain lots illustrate admirably the advantage possessed by the butter made expressly for export over that made to satisfy the New York market; also, in a measure, the British prefer-

ence for boxes over tubs. On five different occasions in April, May, June, and July a discriminating buyer selected and bought for the Department lots of the best creamery butter that could be found in the wholesale market in New York City. Inspected immediately after purchase, this was all officially scored 95 and 96 points in New York. There were 12 to 20 tubs in each lot. This butter was all carefully handled, exported at once, and sold in London, Manchester, and Hamburg. Its average cost was 17.4 cents per pound. That sent to London cost 17 cents and sold for 16.1 cents. That sent to Manchester cost 17.5 cents and sold for 16 cents. With the lots of tubs sent to London was butter in boxes from a New York creamery, which cost 17.7 cents at New York, which there scored 94 points, but which sold for 17.5 cents. And with the tubs to Manchester boxes were sent of butter made in Iowa, which cost 16.7 cents (at point of export), scored only 90 points at New York, and yet sold at 17.7 cents. It is thus seen that the very best current supply of butter at the New York market does not meet the requirements of the market abroad; it is too soft and watery, with a flavor which, although high when fresh, does not hold; it lacks the body, fine texture, and finish which are demanded by British buyers. There is also some prejudice against it because of being in tubs.

The experience with butter bought in the East in 1897 was repeated in the trials of 1898-99. The butter obtained in New York and Vermont cost more at the creameries than any bought in the West, and was more expensive to get to the port of export. The losses in handling this butter were decidedly larger than any others which occurred. The good creameries of the Middle and Eastern States have a home market which is much better than any foreign market yet found for their product. The best evidence of the steady gain made by States creamery butter by being regularly supplied at Manchester week after week for a long period, and the position it was securing at the time the experimental exports closed, is given by the following table. The prices are those of Choicest Danish and States Creamery, sold by the same merchant, the same days, in weeks taken at intervals, progressively, during the year:

Comparative selling prices of butter, per hundredweight of 112 pounds, at Manchester, 1898.

	1.	2.	3.	4.	5.	6.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Choicest Danish.....	96 0	96 0	93 0	92 0	98 9	108 0
States Creamery.....	79 4	81 8	82 0	86 0	93 6	103 0
Difference.....	16 8	14 4	11 0	6 0	5 3	5 0

As already explained, it has been difficult to get the opinions desired from retail dealers and consumers as to the satisfaction given by the

no mottles seen in any of the packages. The salting as a whole was milder and in the main nearly right, but the salting was not uniform. If this creamery will get color two or three degrees paler and salt about as in most of this lot, its butter will come pretty close to choicest Danish, and I am of the opinion that a considerable amount could be placed weekly at prices equally as good as commanded by choicest Danish. The body, grain, and flavor of this make is of such character that it will take a high rank in this market if a little care is given to making the lesser essentials suit the eye.

Manchester, May 28, 1898.—Mr. —, of Ashton-under-Lyne, a flourishing suburb of Manchester, took pasteurized box 10. I called upon him Friday, 20th, and found the butter just turned out upon the counter along with 600 or 700 pounds of Kiel¹ shapes, being Danish and Irish creamery. The butter was a very deep yellow beside the other butter on his counter, but it was still sweet, and gave no signs of deterioration, although the ninth day out of cold store. I called again this morning. His report was as follows: "I put the butter on my counter alongside of the Palace (Irish) creamery at the same price (10d. per pound, about 20 cents) and said nothing to the customers as to origin of either butter. I let them take their choice, as I thought this the fairest way. The United States butter sold first, being preferred by some of my best customers." This merchant is a substantial man and has an excellent trade, and I have put aside three packages of shipment per *Majestic*, subject to his approval when he comes to the market on Tuesday. The Palace creamery is made in Messrs. Dowdall Bros.' Irish creamery, and is regarded as among the finest Irish creamery made, often bringing in the Manchester market prices practically on a par with choicest Danish.

Manchester, May 28, 1898.—Mr. —, of Salford, took box No. 15. I called upon him the morning of 21st, and found the butter on his counter and retailing at 10d. a pound. It was still sweet and fine in flavor and satisfactory.

This morning this gentleman came for another box of our butter, saying that his customers were asking for it. He paid at the rate of 84s. (18½ cents per pound), but objected to the high color.

A Manchester dealer, who took box No. 7, says that, in his opinion, it bears no comparison to best Danish butter. "I am getting 1s. per pound freely for best Danish, for which I paid 94s. per hundredweight, while I have had your butter on my counter six days at 10d. and have not sold 1 dozen pounds. But I may say it is the color and not the quality that prevents the sale. When color is made right I have no doubt but that it will take the place of a second to best Kiel butter."

Manchester, May 31, 1898.—A merchant from a good residential suburb, about 3 miles from the center of Manchester, took nonpasteurized box No. 7. He has a fine trade. This box of butter sold readily on Saturday, and he ordered another to-day, box No. 20 pasteurized being sent him. He sold box No. 7 at 11d. the pound. The flavor and body of good butter. No deterioration. Color objectionable. In his trade the butter would be worth from 6s. to 10s. per hundredweight (1½ to 2 cents per pound) less extra choicest Danish. Eighty shillings per hundredweight was the value of our butter to him on present market, as he could buy choicest Irish creamery not so high in color at about same figure.

The — stores took box No. 3 for their branch at Hulme (now a portion of the corporation of Manchester). I called this morning on the head of this store and found the butter on his counter retailing at 11d., while beside it was a portion of Danish Kiel at 10 pence. The difference in color was that between the dande-

¹ For full description of the Kiel package see p. 203.

lion and the daisy. He explained the difference in price on the grounds that the Kiel was a portion left over from last week and consequently had to be reduced in price. Our box was selling somewhat slow because of the color, and in order to get it to go he said he had to explain to his customers that it was a full grass butter. He said that the flavor of the butter suited his customers better than the Danish, and with color to suit he could sell four to six boxes a week at prices equal to best Danish. This box was one of the saltiest in the lot, but this dealer thought the salt right for his trade.

The manager for ——— took box No. 12 for a thorough examination. I have a promise from him to score the same and let me have his score. He examined the shipment and again stated his opinion that it was better than Canadians except in color. While color is objectionable, he would not refuse it on that score, provided he could get a fixed quantity with certainty every week.

Manchester, May 31, 1898.—The president of the Manchester Grocers' Association, and himself head of a prominent firm, took box No. 5 of those not pasteurized. When I called upon him this morning he told me he had given the butter a thorough examination and had sent it out to his stores to be retailed at 9d. per pound. He said "Its value on the present market is 75s. per hundredweight, but, understand me, the markets this week are peculiar [he then went into explanation of cause], and that the price is below its value under normal conditions. The body and flavor of the butter are good. The box I had had lost its first freshness of flavor and aroma, but there was no trace of deterioration, a point to which I gave especial attention. The color is bad. Under ordinary conditions and with less color, your butter would grade a good second to finest Danish. I estimate it a shade under the best Irish Creamery."

Manchester, July 1, 1898.—The customer who bought the bulk of this butter is one of the keenest buyers in the potteries, and usually expects extra good value. He purchased the last lot of "B's," and the fact that he gave 5s. per hundredweight more proves, apart from the improvement in the market rates, that the quality must have been satisfactory.

London, June 14, 1898.—Twenty tubs of butter per S. S. *Mohawk* were delivered at warehouse of ——— this morning. They got into port last Thursday too late for coming to dock so meat could be discharged for markets Friday, hence agents did not take out meat sufficient to enable the butter to be reached until last evening. The butter was distributed in various parts of meat box, 3 in port wing, 4 in starboard wing, and 13 on table top on starboard side. The box was quite cold, and the temperature must have been kept not above 32° or 33°. The method of discharging is by sling and crane, the crane lifting the object from the hold and putting the same on dock. The handling is most careful. The butter is then placed on a van built on refrigerator principle (same as used for the chilled meat) and carted to the warehouse. The time required is about 3 hours, the distance being nearly 8 miles. I have examined the butter this morning in connection with Messrs. ———. Neither of them understand scoring by points, but both are supposed to be good practical judges. Salt and grain were thought to be right. Color much too high. Flavor about 25 on basis of choicest extra being 40.

This butter is in better condition in so far as sweetness goes than were the tub butters which reached Manchester. They have, however passed their prime, and begun to become slightly rancid. Mr. ———, buyer, examined these tubs this morning and offered 70s. per hundredweight of 112 pounds (or 15½ cents per pound). Said they would have to use them for confection purposes as they could not put them on their counter for retail. Another buyer thought they

would retail for 10d. per pound, but wanted a margin of 2s. Butter was firm and tubs stripped without trouble or any loss from adhering to sides. It is not desirable that these tub butters should be placed as one shipment and for retail, as the result would be prejudicial. London markets do not look with favor on the Welsh tub. It is associated with confectioners' and cold storage butters. I have instructed Messrs. ——— to dispose of them as best they can.

June 25, 1898.—We opened and examined boxes Nos. 3, 7, 10, 11, and 14 of "A" shipment. The butters were sound and in the main sweet, and showed no traces of deterioration through decay or rancidity. The boxes without burlap covering were nice and clean, and no damage to appearance had occurred through lack of covering. The pasteurized boxes, Nos. 3, 7, and 10, were sweet and sound flavored, but the surface had taken up an odor and taste from the wood of the box, which was plainly discernible. The flavor of nonpasteurized "A," Nos. 11 and 14, was also sound and sweet, but inferior to pasteurized. It had also taken up wood flavor on surface. All the butters of the shipment were good bodied and good in texture, and no faults were found on this point.

Two boxes of "A" pasteurized were sent to ——— stores, and I was present when the director examined them. He thought the flavor peculiar and the butters more oily than the butters he was accustomed to, but declared them to be good, sound butters, on a par with the best Irish Creamery, and said he would return 85s. (18½ cents per pound), the price best Irish Creamery was costing him.

Two boxes of "A" nonpasteurized were sent to ——— and examined in my presence by the manager. He pronounced them the best United States butters he had seen, and classified them with Irish Creamery, but thought the best Irish Creamery a shade better. He placed value at 82s. to 84s. He must have liked them better on cutting them up, as he sent word this morning that he would return 84s. for them, and took at the same price four boxes of "A" nonpasteurized.

Mr. ——— sent back the two boxes sent him. He said it was no better than cooking-butter grade, and brought out for comparison with it some vile Irish firkin of third-rate quality. He had to admit that our butter was a little better than this. He then compared it with some New Zealand, and to the advantage of our butter in flavor, and then with some Danish, with like result. But for all this he would not be persuaded that it was better than cooking grade at 76s. He is either no judge or he had other motives in view. I fancy the latter.

London, July 12, 1898.—The butter on examination, Monday, 11th instant, nearly four days after removal from cold stores, was still firm and good bodied, and none the worse in flavor. I am quite satisfied with keeping qualities of all our better creameries. I ate some butter yesterday from one of pasteurized boxes of "A," sent over in shipment per S. S. *Massachusetts*. It was still quite sound and sweet, without sign of deterioration or rancidity. The chief points now are details of salt, color, and packing of packages.

As to grain and texture I can not speak with so much confidence. My own opinion, with my experience, is that our butters are better in body than any European butters I have seen. I mean that they are richer and fuller of substance than these butters, while showing as great solidity. The Iowa butters show, however, a good deal of free water.

In practice we found the cubical boxes difficult to "strip." More or less of the contents was displaced, and it was difficult to get the butter back into the box. This can be remedied only by making them slightly pyramidal in shape. The wood of these boxes also seems to be too thin. In several cases the sides have warped and in a few they have split; besides this, they do not hold nails well, and

part at the joints. More care needs to be taken to provide for rough handling. The Irish Dairy Association have recommended wood fully five eighths of an inch thick, after planing both sides, for all square packages of the 56-pound size, and this seems to be none too heavy. Great care should be exercised also in the selection of material. However well it may be seasoned, all the resinous woods appear to develop an objectionable odor by the time they have crossed the ocean, and if this is discernible examiners are pretty sure to think they detect a corresponding taste in the butter. White wood and other absolutely inodorous kinds are preferred. If spruce or any resinous woods are used, the boxes should be most thoroughly soaked, scalded, and salt rubbed before the linings are put in. The linings must be good, not necessarily of heavy parchment, but that which is strong and of first quality.

The butter in tubs turned out readily, without loss by adhesion to the sides, although in this lot the tub had no linings. Mr. D. is of the opinion that as the weather becomes warmer parchment linings will be necessary in the tubs also, else there will be losses in stripping, for which claim will be made by the retailer.

EXTRACTS FROM LETTERS AND REPORTS FROM SELLING AGENTS FOR THE DEPARTMENT.

FROM MESSRS. DOWDALL BROTHERS, MANCHESTER, ENGLAND.

Manchester, April 12, 1898.— * * * We are quite prepared to make reports on each lot as it arrives. Speaking generally at the moment, we should say that butter intended for this district should be comparatively pale, and for London comparatively colory. To describe color more nearly, we should say average color would mean a blend between the yellowness of a gold coin and the whiteness of lard. Therefore what we call a pale color for this district would mean one shade lighter than the average, leaning toward the lard side, and for London one shade deeper than the average, leaning toward the gold-coin yellowness.

As to salting, speaking generally also, we should say 3 per cent of salt for this district and 2 per cent of salt for London and the south of England.

The commission is 3 per cent on gross sales. For this we will guarantee the Department against any loss by bad debts, and will include all expenses for handling, cartage, fire insurance, etc., which usually may be counted as 1 per cent. We would make no charge for writing special reports. We understand that the goods should be sold specially as the produce of the United States, and so that they can be traced, so far as possible, through the retailer to the actual consumer.

We are pleased to note that your ambition is to range side by side with Choicest Danish. Of course distance and time are a bit against you, but with the well-known talent and enterprise of your people, we have every reason to hope and believe that you will run them neck and neck. It will be our duty and interest to help you all possible in this direction. You, of course, will observe two essential points, namely, maintaining uniformity of quality and regular shipments, so as to make your butter known and generally used.

Manchester, June 29, 1898.—We beg to report sale of the 20 boxes marked "C." We were successful in placing these as follows: To a principal grocer in Oldham we sold 6 boxes at 80s.; to an extensive cutting grocer in Manchester, with many branches, 6 at 82s.; and to a most respectable family grocer in Macclesfield, 3 at 82s. All these customers have been specially directed to this class of butter, and they promised to give it a fair trial, and to let us have, later on, the benefit of their opinions as to its suitability for their trade, all of which we will communicate to you in due course.

NOTE.—The quotations are in English shillings for 1 hundredweight, or 112 pounds, of butter.

Manchester, July 1, 1898.— * * * Quality scarcely so good as last, there being too much water left in the butter, spoiling the flavor. The salt also appears to be of a strongish sort, and perhaps about nearly 1 per cent too much. Average price made, 85s. 6d. in Manchester, advance of 1s. 6d. on last lot. The butter was disposed of among six customers, as follows: "L," 5 boxes at 86s.; "C," 6 boxes at 86s.; "O," 1 box at 88s.; "P," 1 box at 84s.; "Q," 1 box at 88s.; "R," 6 boxes at 84s. Average, 85s. 6d., or 18½ cents per pound. The butter was also scored, the grading being done (as on former occasions) by giving 45 points for flavor and 25 points for grain. Tester No. 1 (Mr. J. S.) made average 84.6; tester No. 2 (Mr. G. D.) made average 85.6, in a total of 100 points.

For the sake of comparison with the States butter reported upon above, 3 packages of butter from other sources were examined at the same time and notes upon them made as follows:

Box "N" of Irish Creamery. Average points scored, 98. This was the finest sample of Irish Creamery butter received by us this year, with fine fresh flavor; grain perfect and waxy, but not too tough; water well expressed; color of a light pale straw; salt 2½ to 3 per cent; packing very carefully done, package very neat and clean, with nicely embossed brand on outside, and canvased. Made 90s. per hundredweight, Manchester, as against 93s. for Choicest Danish and 85s. 6d. and 80s. for States Creamery.

Box "DD" of Irish Creamery. Very fine sample of butter, beautifully fresh made; flavor nearly perfect; grain good; slightly color; salt 3 per cent; package good and clean, and covered with canvas. This butter made 90s. and 88s.; average, 89s., or 19½ cents per pound.

Box of Canadian Creamery. Had apparently been cold stored, and was becoming rather strong in flavor; grain fair; butter slightly soft and watery; color right, pale straw; salting correct; and package very good, nicely embossed on outside with brand. Value, 78s. to 80s. per hundredweight, or 17 to 17½ cents per pound.

Manchester, July 19, 1898.—We are pleased to note that you are making for the first time an effort in direction of slightly pyramidal form of packages. We shall report on arrival. We think the form advantageous, as the butter is more easily removed on opening; but for good, firm, well-made butter like yours the pyramidal form may be slight and not too pronounced. We think it a thoroughly good idea to have the baskets [boxes] coated on the inside with paraffin and additionally lined with parchment. Of course it will be best to have the boxes to hold something slightly in excess of the 56 pounds, in order to make full weight when they reach us. In this case it will not matter, as we shall arrange with customers, so that they shall not be disappointed.

Manchester, July 26, 1898.—Respecting boxes: We do not like to be dogmatic, yet in respect to the two styles you refer to, from a preliminary examination, we do not think the package used for the butter "N" is value for twice as much as that used for the butter "A." We admit it is the most attractive and no doubt will be acceptable in any good market, but buyers do not sufficiently estimate this age to pay anything extra for the appearance. We do not know what your cost, but we find that our own 56-pound boxes delivered freight prepaid creameries in Ireland cost 10d. (20 cents) each. It must, however, be ad that they are nothing near so good or so substantial as your very splen-

CIRCULAR DISTRIBUTED BY DOWDALL BROS., BUTTER MERCHANTS.

MANCHESTER, July 21, 1898.

Sir: The States Government are now exporting the produce of specimen "ry" to secure a place alongside and compete with other choicest

quality butters on the British markets. A special consignment to us lands to-day. The butter is fresh made and reached here just as soon as Canadian or Finnish, and nearly as early as Danish.

The States creamery butter is well made, well flavored, of suitable color and salting, nicely packed for easy turn out, in specially prepared pyramidal boxes, and we are commissioned to offer it at moderate price. We ourselves have closely tested the quality of each successive experimental shipment and can recommend it to the trade.

Irish creamery rates are much firmer. Danish is officially unchanged, but independent quotations are higher.

Your visit of inspection, or order, will be esteemed.

Manchester, August 6, 1898.—To-day Mr. C. (partner in the house that has almost, if not altogether, the greatest reputation for the best butter in Manchester, and who is generally accepted by the trade as one of the keenest and best judges of butter) said that the "N" creamery is the best American he has yet seen, being good, rich, and keeping butter, comparing well with Danish. He bought 5 boxes at 88s., a big price from such a man, who cuts rates, and is running the butter next week in place of one of his Danish "cuts."

Winter supply: During the winter 1897-98 we had some intermittent supplies direct of fair quality Canadians in boxes, but in January and February, 1898, we were obliged to procure from a neighboring house who have connections with the Canadian Government and who seem to have here almost a monopoly of Canadian creameries. There is no reason, if prices be suitable to the American creameries, why States butters should not, during the above period, when Danish is sometimes unworkable for certain retail prices, have a share of the business as well as Canadians. The Canadian butter at that time was good waxy stuff, of a pale, sweet sort, sometimes inclined to be a little strong. Each week's shipment or arrival was eagerly awaited; supply was often short of demand and had to be proportionally distributed among the buyers. What can you do toward a winter supply?

Manchester, August 17, 1898.—You will note in our accompanying report that one of our large retail customers says that this butter just hits the Manchester tastes and requirements. We are glad to note also that the excessive color of which we complained has passed away. The butter may be made now quite in its own natural color, without any addition whatever of coloring matter. * * *

We again express our approval of the slightly pyramidal packages. It is a first-class package in every sense. They have come in first-class condition, and the six small screws are excellent. We have seen no damage from custom-house inspectors. On the contrary, we should think it would help them. We are quite of your opinion of the superiority of the Wisconsin package, if the comparative merits are not outweighed by cost. Of course you know that best. The cubical boxes hold together fairly well and we have no damage to report lately as to seams started or otherwise.

We quite concur in your views and objections to putting States butter in Danish casks. The butter is good enough to make its way without copying any other nation. We are glad, however, you adopted the box shape, because it is much preferable to the so-called Welsh tub. The latter having a bad reputation would damage even good butter. Hence, you see, in spite of all, the package has something to do in the initial stage. The highest grade butter comes in the Danish cask and many buyers would prefer it. We seldom dictate to our buyers as to what they desire, the competition of supply from most countries being so much that buyers here are usually masters of the situation and we try to follow their wishes.

Manchester, August 24, 1898.—We inclose you a plain short summary of the butter shipped by you to us, with the average prices we realized here and the price

of strictly choicest Danish butter on this market on the same dates. You can analyze the particulars for yourself. Our point is that we have lessened the difference in the realizable value between your butter and Danish as we have gone along, and we have made decidedly more for it than what Canadian butter has realized on this market. We are strongly of opinion it will pay you to continue your experiments for some time longer. During the greater part of the time you have been shipping to us, butter generally was higher in the American markets than realized on this side. You will observe our last average comes out at 93s. 6d. per hundredweight, Manchester, or only 5s. (1 cent per pound) below the strictly choicest Danish. We hope you will consider this good and encouraging progress. The markets have been against you in England this year, as we are lower in price than we have been for the past thirty years. Last year butter here ruled about 10s. per hundredweight higher than the present price. We think the advantage of continuing your shipments will be to familiarize our connection with your produce in a favorable manner, and should it arise that our prices in England advance to a sufficient margin over prices in the States, it would give you an outlet for your butter and prevent your home markets from being glutted, with the consequent result of a fall in price. In short, the butter markets of the world are now in such close touch that, like water, they all tend toward a level. It follows, nevertheless, that at the first introduction of a new butter it has to be sold at tempting prices to get customers off what they have been accustomed to.

Manchester, November 5, 1898.—Refrigerator: We suspect the cause of the bad condition is that the butters got knocked about in the vessel's hold, whereas in the refrigerator they may have had better storage.

Quality of butter: We think refrigeration en route is almost necessary to keep condition right until arrival. The last two shipments of "N" and "A" have been off and stale on arrival. Please consider whether it would not be preferable, for both quality of butter and good condition of boxes, to continue shipping in the refrigerator or beef boxes.

Frozen versus chilled butter: Cold storing of butter has been in Manchester much more practiced this year than before. The manager of the Manchester Corporation Cold Stores informs us that this is their practice: For storage three to seven days only, chill the butter to 30° to 35° F. For storage one to two months or more, freeze the butter to 20° to 26° F. He says he freezes all the butter unless specially instructed otherwise, and that frozen butters keep flavor and taste best on opening, whereas chilled butters come out smelling and tasting stale. Our Danish cold-stored frozen butter came out this year very well, but they were very carefully selected as to quality before storing. With regard to the States, we think refrigeration en route quite sufficient to deliver in fair testing condition. A feeling against frozen butters is spreading among the retail grocers. They say it early disintegrates on the counter and customers don't like it.

Manchester, November 19, 1898.—The "Wisconsin box." A good name, describing one of the best packages we have seen.

Butter color: Unless the butter comes dead pale, use no color whatever. A pale straw is our tint. London color won't do here. Further remarks on color and salt will follow.

Manchester, November 23, 1898.—Another cause of our not being able to make more of the States creameries on Tuesday, 22d instant, was that Australians are now on our market. We bought some in London at 106s. (23 cents per pound) there, and fetched them here for sale. The Ululu dairy in particular was very fine, and we sold it at a profit. They make 108s. and even more for some sorts.

We also bought Canadians, which were very fair butters, and made 106s. for them, leaving ourselves a very good margin.

These two classes are now pitted against States, and there being plenty of them, the prices of States are prevented from rising to those nearer the Danish level.

Manchester, November 26, 1898.—Shipment XLIV noted and having our attention. Have already sold in advance more than half of it at 110s. and 112s. per hundredweight, Manchester, and are working for 116s. (25 cents per pound) for the remainder. The Danish quotation rose 4 kroner on Thursday. There is a perfect famine of Scandinavian butter. The best quality will fetch here on Tuesday 125s. or more. The States creamery butter is, therefore, in excellent demand and should really make more, but for the activity with which middling Canadians, fair Australians, and cold-store States are being pushed at from 94s. to 104s., which injures the prices made for fresh States. We bought some very good refrigerator Elgins at about 97s. (21 cents per pound), or the London equivalent.

Manchester, January 25, 1899.—We report as follows upon the average prices made upon five recent shipments:

Ship-ments.	Lots L.		Lots N.		Danish spot price, Manchester.
	s.	d.	s.	d.	s. d.
XLVII ..	109	2	107	10	116 0
XLIX ..	109	2	109	5	115 7
L ..	106	0	106	0	113 0
LII ..	105	6	105	6	109 0
LIII ..	104	2	103	8	109 0

The foregoing shows that the average selling price for States Creamery during the last five weeks has been 107s. per hundredweight [or 23½ cents per pound], against average Danish spot price made on Manchester market 112s. [or 24 cents per pound]. This is only 5s. lower, which we consider a good result. You will note that for shipment LII, the price for States was but 3s. 6d. per hundredweight [or three-fourths of 1 cent per pound] less than Danish.

Scoring shows that the "L" butter keeps rather better than the "N," but they are both really good butters and certainly finer than the bulk of best Canadians, which have not been so good this season.

Manchester, February 15, 1899.—The goods in shipment LVI, which presumably left New York on Saturday, the 4th instant, have not yet arrived. They would leave the creameries on or about January 27. The steamers have been rather late in unloading for the last few weeks, causing the butters to miss our markets. Fortunately, we have most of the butters sold to arrive. We notice lately a slight taint of age in the produce of both factories shipping to us, and a few days saved in transit might obviate this. We understand that from the creamery until day of shipment in New York nearly nine days sometimes elapse. For instance, in shipment LV, lot "N" left the creamery in Wisconsin June 20, arrived in Chicago on the 21st, and left New York seven days later. Could not a part of this time be saved on the road, or could not the creamery ship a day or two later and yet catch the same steamer? On our part at this end we are endeavoring to hasten the people controlling the beef boxes in the unloading of goods. It would be a good thing if four to six days could be saved by extra expedition at both ends.

Manchester, March 29, 1899.—We note you say that the experimental exports will probably have to be discontinued next month at any rate. May we ask the

reason why? We hope you have been satisfied with our treatment of the butter all through, our reports, and the results of our sales. It seems to us to have been a year in which high prices ruled in the States, and therefore the benefits of exports would not be so palpable as if you had a low market, as in former years, and we had a tolerably good one.

Manchester, April 5, 1899.—We still hope to hear that you can continue the shipments. Over 150 retail grocers in the north of England have now used the butters and only the smallness of the quantity has prevented a wider distribution. It would be a pity to let these customers now get on to another class of butters. We are dealing largely in Frieslands just now, but they have little grain or waxiness, and often get "fishy" and "off" in a few weeks' time.

NOTES AND COMMENTS FROM REPORTS OF DOWDALL BROTHERS.

August 2, 1898.—Customers' opinions generally favorable. Individual opinions will follow by early post. [But they did not.—H. E. A.] A large Manchester retailer said: "This butter just hits the Manchester taste and requirements."

August 15, 1898.—To introduce these good butters among a wider circle, and show their gradual approach to choicest Danish in quality, etc., moderate prices were accepted. Lot XVIII, "A." These boxes were without canvas covers and arrived in rather dirty condition. Weather here wet and dirt may have got on between Liverpool and Manchester.

August 21, 1898.—This butter is taken now by retailers as against Danish or as a substitute for it. The Danish price quotation being advanced and grocers unwilling to alter present retail prices.

September 8, 1898.—Customers' opinions still favorable and the butter in request. It is close on to Danish quality.

September 23, 1898.—Customers seem to be holding on. Must be suited, for if not they would go onto something else. The good grain and body of this butter helps its sale very much.

September 30, 1898.—Still comparing favorably with best Irish Creamery, although of course not quite so fresh.

October 22, 1898.—Butter continues good. The grain is right, although body a little softer because not shipped in refrigerators this time. Freshly made Irish Creamery are preferred for their freshness, but this States butter is generally firmer, waxier, and of closer grain.

November 29, 1898.—The "L" butter is good, coming close on best Danish; much liked and could have sold many more boxes. Brisk market and extra prices on Danish drove retail grocers to States butter.

December 10, 1898.—The "L" butter is first rate, notwithstanding a slight impression of fodderiness in the aroma. Compared with the best quality of Argentine butter on this market, the grain of the States was preferred, that of the Argentine being too weak and silky. But flavor of latter was rather better, although it did not last after it was opened. Average score, 20 boxes of "L," 96 points. The "N" butter keeping steady and improving; think the steamer refrigerator helps. Color now wanted paler; Danish and Canadian being much less high in color at present. Average score, 94½ points.

December 22, 1898.—"L" good, sound, well-made butter. Customers like it and want more. Slightly fodder flavor noted, but not disagreeable or complained of.

December 31, 1898.—"N" good, sound, waxy butter. Customers' opinions favorable.

January 10, 1899.—This States butter preferred by our customers to the best Canadians now on the market. Average, 95½ points.

January 24, 1899.—Notes on "L" butter: Flavor very nice, 36.3; grain, good, 30;

color, right, 15; salting, right, 10; packing, right, 5; average of 96.4 points. General quality, good. Customers' opinions, very favorable.

February 2, 1899.—Very clean flavor, nearly as good as Swedish; 96.6 points. One customer said: "Pity 'tis packed in square boxes, for it's as good as Kiel butter."

NOTE.—This prejudice against boxes will die out. Consumers are gradually being educated to prefer and seek quality, whether found in boxes, casks, kiels, or other shapes.

February 7, 1899.—This lot of butter is soundly made, robust, and good looking, but the flavor is sadly "off;" it doesn't keep. Customers express surprise at such a change, and suggest various explanations. We know the fault is there, but can't say why. Score, 92 points.

March 4, 1899.—Increasing inquiry by customers for the States butter.

March 16, 1899.—Excellent. This butter preferred over all others at its price.

March 22, 1899.—The packing is not so good as formerly. Top of butter in boxes should be as if perfectly leveled with a plane. This seems rounded up on top and shows marks of tools. Butter itself excellent.

April 9, 1899.—Customers' opinions still favorable, but flavor of butter not now quite up to weeks past.

April 27, 1899.—Fair for this time of year, but fodderiness perceptible.

May 10, 1899.—No refrigeration on the steamer, and flavor of this last lot of butter suffers some in consequence. Customers a little shy now, but will go on to this butter again, if it comes when from full grass. Report: Flavor, fodderiness, 34; grain, excellent, 30; color, a bit pale, but no discount, 15; salting, right, 10; packing, good, 5—94 points. General quality good, excepting off flavor.

FROM MESSRS. R. CARTER & SONS, LONDON, ENGLAND.

Gillspur street, E. C.—London, August 6, 1898.—The 10 boxes of lot "F," solid packed, is the finest butter you have as yet sent us. It arrived in excellent condition and well packed. A regular shipment of a butter like this would take its position among the best quality of butters we receive on our market. The drawback at present is that we can not guarantee buyers a regular arrival of same butter, and so the majority prefer to keep the Danish for their best retail trade.

London, August 13, 1898.—We have followed up lot "F" of this shipment, and found they have pleased very much. We saw two packages which had been opened and exposed for sale in a shop for nearly a week, and they had stood exposure very well.

London, August 19, 1898.—The butters you are sending us are coming very regularly, which is a great point. A customer often buys butter from sample package and will, after seeing same, say, "Send me 2 or 4 unopened packages." You will therefore see why we attach so great importance to regularity of butter in each dairy. Butters of "L" and "F" lots have stood very well the tests of hot weather we have been having here. You will be glad to hear that some of our customers have used your butter in place of Danish for best 1s. 2d. per pound [28 cents] retail, and report satisfactory results, but the greater part of your butter has been sold for 1s. retail in place of Dutch and Irish. With present prices of butters, indeed, several retailers are not selling salt butter above 1s. per pound retail. Best fresh butter in 2-pound rolls, 12 in a box, without cloth round them, coming from Brittany, usually commands 2d. per pound more than best salt.

London, September 10, 1898.—We should have mentioned to you in our last that we sent some packages to a customer with whom we have a big contract to supply with finest New Zealand butter throughout the summer. We cut off some of the New Zealands and sent some of the "L" dairy of shipment XIX to see how it took, and hear that they were received with the greatest favor. In making up

prices your butter fetched, we entered up these few packages at the highest the rest of the lot was sold at, 98 shillings per hundredweight. We thought this the best way, as the contract price the customer referred to was paying would have been no fair guide to you. We have placed these people onto New Zealand again, but mention this as of possible interest to you.

London, November 1, 1898.—We have had two lots of butter from your country direct from the ——— dairy. The first came in bad condition, and we could return only 89s. [19½ cents per pound], but the consignment to hand this week was very good. We are returning 103s. for these [23½ cents per pound]. We think these must have been in cold-air chambers. We doubt whether butters sent even in the winter will keep right if not in cold-air chambers.

London, November 9, 1898.—We are receiving colonial butters now and are expecting large quantities further on, so do not think it advisable for Messrs. ——— & Co. to ship, and have written them so. We are of opinion that in the interests of American creamery companies it is best for them not to ship here till about April.

London, August 31, 1898.—We send to you by this mail a few reports on your butters from some of our customers which we think will prove of use and interest. In asking for these reports we have selected customers who are not only good-class men of business, but also very keen judges of butter. You will notice that while they generally prefer your butters to Australian and Irish, in comparing them with Danish there is a considerable difference of opinion. A very experienced buyer in a large way of business saw your butters last week and told us he would never think of using them in place of Danish for his best cut retailing at 1s. 2d. [28 cents] per pound, while for his 1s. retail he could buy butters nearly as good as the Americans and which answered his purpose quite as well at 4½. less per hundredweight.

EXTRACTS FROM LETTERS FROM RETAIL MERCHANTS (WITH NOTES BY MESSRS. CARTER).

Upper Norwood, London, S. E.—Regarding the boxes of American butters I received from you, they are very good butters indeed, and I consider they compare with Danish very favorably, but I can not agree with packing 1-pound lumps, as they have to be all turned out and reweighed, and there is a greater tendency to get rank on the outside. The ideal package is the 56-pound cubical box, as we always prefer to weigh our own butter, and also to be able to show it in bulk. At the same time I should give Danish the preference at the same price.

NOTE.—The writer of the above represents a good business in high-class neighborhood. Trade a family one, but also good cash trade as well. He has been in business a number of years, and we regard him as a very good judge of butter.

Walworth, S. E., August 17, 1898.—In answer to your request for a report on the box of American butter (rolls) received last week, my opinion is that it would be better in the bulk and not in rolls, as during this hot weather there is a certain amount of loss by the butter adhering to the paper the rolls are wrapped in. I also am of opinion that the butter does not keep so well in rolls wrapped in paper as in the bulk. I should certainly pay more for the latter than for butter in paper-wrapped rolls.

Beckenham, August 19, 1898.—I am very pleased with the quality of the American butter you sent me, and think it is quite equal to Danish, being good flavor, well made, and stout butter packages, very clean and neat. I shall be pleased if you will forward me two every week.

NOTE.—This is from a medium-sized general store in a very wealthy neighborhood. Probably every pound of salt butter would go out at 1s. 2d.

Croydon, August 7, 1898.—In accordance with your wish, I make the following report on American butter bought of you this week: I find it of excellent quality, perfect in flavor, well made, and has given satisfaction to customers, but I think if in the making a little less water was left in it it would be an improvement. Compared with the finest dairies of Danish, it would in my opinion stand no chance. At the same time I should prefer it to Finnish or Irish. I am of opinion that for the London market bulk would take better than rolls, but for the country trade—that is, among grocer-cheesemongers—the rolls would be perfect.

NOTE.—From a business in suburb, 10 miles outside of London, medium-class trade.

South Norwood, August 3, 1898.—The States butter introduced by you a short time since turns out very well and promises to be a very useful addition to our market. While not quite so delicate as our best Irish creamery, yet they compare favorably in color and texture, and their keeping quality seems to be excellent. They are evidently thoroughly well worked.

Plaistow, E., August 22, 1898.—Re the American creamery butters: I may say I like them very much. If the standard quality is kept up I prefer them before the Australians. I should say if packed in bulk it would keep better than in 1-pound rolls, although it is very convenient if sold in same, but if cut would be a little wasteful.

Lewisham, August 29, 1898.—I am very pleased with the States butter you have been sending me lately. I consider it perfection as a salt butter, and should have a large future before it, providing the quality is kept up to the present standard.

Sutton, Surrey, August 30, 1898.—With reference to the American butters you have sent us, and their suitability for our trade, we beg to say that we consider they are fine butters, but we can not work them in place of choicest Danish butter. We have found only one serious fault, and that is they are inclined to be "sidey."

NOTE.—This is from a good-sized, very high-class provision business, in a suburb 12 miles out of London, where there are numbers of well-to-do people residing. This man cuts about 15 boxes fresh and 4 or 5 hundredweight of salt butter weekly, and is a very keen buyer and tradesman.

Kew Gardens, August 20, 1898.—We have tested your American creamery for about a month, and find the butter excellent and it pleases well. It has a great future, providing it still continues to arrive the same quality and condition. We consider it equal to the finest Danish.

NOTE.—This man does a large dairy trade. At his Richmond shop, where he has had your butters, he does a very good-class trade, which he would have to study. For years has cut nothing but the best shipped Danish.

Surbiton Hill, August 26, 1898.—Re boxes American butter: They are absolutely perfect. I do not think it possible to obtain butter in higher perfection.

Croydon, August 25, 1898.—We have inspected the sample of American butter, and consider the quality excellent, and at this season of the year equal to Danish. We intend trying it for a test. Butter is exceedingly well gotten up. Please send another sample box from next shipment.

Notting Hill, W., August 30, 1898.—The boxes of butter which I have had from you have given much satisfaction, and I don't see how they can be much improved upon. I admire the care which is being taken for their preservation, and so long as that is done they will find a ready market in this country. In packing the rolls care should be taken with the weight. We find they are all a little short of the avoirdupois pound; that, of course, adds to the price. The quality is prime, flavor nice, and also well made, the grain not being destroyed by too much mill-

ing. That is one of the faults of the Brittany butter. The reason that years ago those butters (Brittany) so took on was their freedom from any pronounced flavor, and if these States butters are to hold their own care must be taken that the flavor is always free from anything predominant, even if they approach insipidness.

NOTE.—Mr. —, who writes this report, is a thoroughly practical cheesemonger of many years experience. He has a very fine West End business, in which he works himself behind the counter, and we regard him as one of the best judges of goods in our trade. His opinion is as valuable a one from a retailer as could be obtained.

The Messrs. Dowdall have kindly sent a general review of the year's work, and, although repeating some of the facts and suggestions given in preceding pages, this letter is worthy of being here inserted:

DOWDALL BROTHERS, SHIPPERS AND AGENTS,
32 Hanging Ditch, Manchester, July 14, 1899.

Maj. HENRY E. ALVORD,
Chief of Dairy Division, Bureau of Animal Industry,
United States Department of Agriculture, Washington.

DEAR SIR: We are now in a position to give you a few observations on the experimental shipments you made to us of butter from the United States for a period of about twelve months ended last May. During that time we received from you in all a total of 47 shipments. We may at once say that everything in relation thereto redounds to the credit of all concerned. As you know, we sent you detailed statements after the receipt of each lot, according to your request. We kept in mind constantly that your object was to test the English market in a practical manner with those experimental shipments, and by the actual prices realized to ascertain the net result, as compared with butters from various other countries coming regularly to this market. We must at once say, judging by the butters we received, that the quality produced in certain parts of the United States is second to none of the commercial butters reaching this country. It must be borne in mind, of course, at the same time, that to some extent they suffer a disadvantage on arrival here, as may easily be imagined—that is, taking into account the distance the United States butter has to travel before reaching the English market and the time occupied in coming. When this is compared with the conditions under which butter from Denmark comes here, it will be readily seen that Danish butter has advantages in this respect. Bearing this fact in mind, we think that American producers need not be discouraged when the prices obtained here for their butter of the best sort is compared with that of Danish. The reason we make this comparison as to Danish butter is because the latter holds the highest position practically in the English market of all imported butters. From that little Kingdom this country buys every year butter to the value of more than £7,000,000. There are parcels of butter received from France which realized even higher value than Danish, but this quantity is comparatively small, and as the French can often find their best market in Paris, we leave the comparison out of question.

You will be pleased therefore to know that, reducing the prices of Danish butter, of the best Irish creamery butter made in steam dairies by the separator system, and of the best mild-cured superfine butter made by the Irish farmers, with the price of the best creamery butter you sent us from the United States, to the level of common conditions on this market for the season May 1 to November 29, 1899, the results stand as follows per hundredweight:

	s.	d.
Danish spot, average price.....	106	6
Best Irish creamery butter.....	100	0
United States creamery.....	97	4
Superfine Irish farmers' butter.....	90	0

For the succeeding or winter season, from November 21 to May 10, the following were the average prices obtained per hundredweight:

	s.	d.
Danish spot, average.....	108	6
Contract and cold-stored Danish	104	8
United States	103	0

Or, taking the average over the whole period, we would give an average price of Danish butter as 107s. 6d. at Manchester, as against the United States butter 100s. [NOTE.—This would be relatively 23½ and 21½ cents per pound.]

We consider this extremely creditable to the production of the United States. We get the butter from Denmark within a week, while from the dairy center in America to our market the period would average seventeen to twenty-two days. We would, however, wish it to be understood that we placed this fine butter in the hands of good retailers, who were favorably disposed to give the United States butter a fair trial, and we probably therefore attained a higher average price than if the entire open market were challenged. To put against this, however, on the other side, we must add that the introduction of a new butter, or butter from a new district, very often has to be sold slightly under its value to induce buyers to give it a trial and to get them to change from their old sources of supply.

In our various communications to you we dealt upon different points that would be worthy of the attention of such dairymen or exporters who would desire to do a regular trade with England. In former years most of the butter shipped from America was sent in tubs or pails, and this butter, being made under the old system, and being generally not of the highest grade, but most often middling or inferior, prejudiced the buying public in England against American butter in those packages. Therefore it would have followed that had you shipped the very finest butter from the United States in similar tubs it would have been difficult to have removed the prejudice of buyers to such butter, and it would have had to be sold below its actual value. This prejudice is not altogether without sufficient reason. The consuming public, buying their butters from retail counters and noting the form in which butter is packed, have discovered by use in which package the best descriptions of butter are packed. The Danish butter comes to us in Kiels, or casks, of one hundredweight. Knowing this fact, we wrote you asking you to pack your butter in a similar package, which would have enabled us to realize a few shillings per hundredweight more for the butter. From your point of view you very properly refused to do so, stating that you wished no deception whatever to be practiced on the English consuming public, and that you were desirous that the United States butter should be placed before the English consumer entirely on its own merits. We thoroughly appreciated your view, which we looked upon in principle as perfectly good, although it does not always conform to the necessities of commerce, which your practical men will easily understand. You decided, however, to pack it in a 56-pound pyramidal box. This was the very next best you could have done, not only in accordance with principle but in accordance with commercial ideas. The whole of the Australian, Canadian, and New Zealand butters coming to this country are packed in a 56-pound square or oblong box. We, however, pointed out to you some disadvantages of using this box. It is the best package for transmarine shipment, but sometimes difficult to turn out on the counter. You adopted a slightly pyramidal form, which had all the advantages of the square or oblong 56-pound box with the superadvantage of being easier to decant, or turn out, on the counter. We will also say that the box you sent us was the very best in the market. Nothing superior, if anything equal, has ever appeared on the English market before. With the inside of the box waxed with white paraffin and the butter inside wrapped in grease-proof parchment and the outside of the box with a slight covering of canvass, the box opened here in

the most perfect condition, and with the lids put on by brass screws and the outside of the box having a label with full declaration of place of origin, destination, weight, and other descriptions, there was nothing left to be desired.

We reported to you that after repeated and close observations of our own, as well as our customers, we could not give any decisive opinion that there was any advantage whatever in pasteurization over the ordinary method of treating the cream. We touched in former reports on the question of flavor, which we reported to be good nine months out of the twelve, while in the remaining period the butter had a fodderly taste and certainly did not keep so well. We judged of this that the produce must have been from winter feeding. As to the grain of the butter, it was always perfect, waxy, and not too hard. As to color, in the summer it was rather too high—that is, too yellow—while in the early spring it was too pale. This is exactly our own experience in the creameries with which we are connected in Ireland. The color that is most suited to the English trade is a pale straw. As to salting, we would recommend 3 per cent, and as to packages, that description which you call the Wisconsin box.

Fortunately for American producers, and as a testimony to the great prosperity of your wonderful country, we notice that for some time your best butter has been realizing a price in the United States which we could not at all pay in England. We know, of course, that to some extent your experiments were directed not for any immediate practical benefit, but to ascertain if, with the extension of dairying in the United States, that the surplus production could be profitably exported to England. When we say England, of course we mean Europe, as we are the one great importing country of butter in the world, and if the prices are not profitable by shipping to England, then the remainder of Europe may be left out of the question, as we are importing from all European grass countries. Our annual needs in the way of butter amount to 10,000 tons more than the previous year, as our population is growing at the rate of about 400,000 per annum. Of our colonies, the exports of butter from Canada have increased the most rapidly, while the imports to England from Victoria, New South Wales, and New Zealand also show great strides.

With regard to eggs, we have nothing but praise for the eggs you sent us, and you will already have had an account of the prices we are able to realize. This will enable you to judge better than ourselves as to whether or not there has been a paying margin for shippers from the States to this country.

The tendency in England is continually for better and higher-class goods, and medium and inferior are more and more difficult to sell. The industrial population is better paid and fed and more fastidious; hence the lines to be followed in competition should be always higher and higher quality rather than cheaper and lower prices. In the latter case, goods not up to the highest standard of quality have to be pushed off at a loss to find a suitable market, and we would not recommend exporters to find an outlet for inferior goods with a view to profit making. Such goods have to come into competition with good margarine, which intrinsically is more palatable than inferior butter; and were it not for the manifest prejudice that there is against the article would, to the unbiased taster, invariably find a preference. The moral is that inferior butter making is doomed to extinction, as in the long run we feel convinced that everything will tend toward the sale of the best butter and the best margarine, and anything between will have but a poor chance.

Those are our views generally; and we beg to thank you in conclusion for the great confidence you reposed in us by placing in our hands so large a part of the goods you exported experimentally, and for finding our results and reports satisfactory to yourself.

If at any time it may be your desire to ascertain further reports of our market

or practical results from consignments, we shall be most happy on all occasions to place our services at your disposal.

We beg to remain, yours, very respectfully,

DOWDALL BROTHERS.

The foregoing extracts include not only an interesting variety of opinions but numerous facts and suggestions. From those, together with the body of the report preceding, a number of deductions may be made. These will be stated in the form of a final summary, which involves considerable repetition from the similar report for the year 1897.

The greatest existing demand for butter of good quality, and the demand which promises to be the most constant and reliable, is found in Great Britain.

Large quantities of the best creamery product of the United States can be sold in the British markets for years to come provided the prices obtainable in those markets are enough higher than those in America to make exports profitable.

For several years the relative market rates in the two countries and the standing of States butter in Great Britain have been such that only at intervals and for comparatively short periods has commercial inducement been offered for this export trade.

For a time butter from the United States will be most acceptable from April until October (partly inclusive), or while the English markets are free from the large arrivals of fresh Colonial butter—from Australia and New Zealand—which occur during the remainder of the year. Canadian creamery butter is being sent to Great Britain in constantly increasing quantities at the time the States product is most in demand. The average run of this butter can not now be regarded as a serious rival to the same nominal class of goods from the United States, but the Dominion Government is doing so much to foster and promote the creamery industry that there is constant improvement in the product. There can be but one result unless equal exertions are made in behalf of butter from this country. There is no reason at present why creamery butter from the United States should not compete successfully in all markets of the United Kingdom with butter from Canada and Australia, and at all seasons of the year. But this is a secondary position commercially, and should not satisfy American ambition. States butter should aspire to equal in British estimation the Choicest Danish and all supplies occupying first rank. Abundant evidence has been presented to show that this can be accomplished by following the course so plainly indicated.

Attention has been called to the criticism that our butter was sometimes too watery, but in the 1897 report it was shown by both American and English analyses that the water content of States butters was low and it was exceeded by the amount of water in the imported samples of foreign-made butters. The same is true for the

two years covered by the present report. (See Appendices XVII and XVIII, pp. 240 and 242.) Of the 43 analyses of exported States butter none shows over 15 per cent water, while 5 of the 28 imported samples contained more than that amount. The averages of water content show a difference of 1.98 per cent in favor of the States. The lowest and highest and average amounts of both water and fat in the States and foreign butters are given in the following table:

Comparative composition of butter, United States and foreign.

Butter from—	Water.			Butter fat.		
	Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
United States	6.72	14.93	11.24	80.18	91.23	85.99
Foreign	10.25	19.10	13.22	70.59	86.63	83.75

Thus it is seen that purchasers obtained 2.15 pounds more of pure butter fat per hundred pounds in States butters than in others. Additional advantages of our butter shown by the chemists are the smaller amount of curd, .98 per cent as compared to 1.14, and the entire absence of preservatives. These remarks apply, of course, to the averages. By examination of the table of analyses it will be seen that some individual foreign butters were of high standard.

As to distance and the difficulties of transportation, the United States is at some disadvantage as compared with Denmark and Sweden, on a par with Canada, and possesses decided advantages over Australia. Yet time and distance are almost annihilated by modern methods of transportation for perishable products, and while Canada has at present (thanks, again, to an assiduous paternal government) much better facilities than the United States for delivering butter in England in prime condition, like facilities will undoubtedly be provided from our own ports whenever justified by the volume of trade. Refrigerated transportation all the way from the creamery to the British market is evidently essential for the greater part of the year, and if obtainable at reasonable rates, it will probably be found truly economical at all seasons. For exporters from interior points temporary cold storage and forwarding agents at the port of departure seem to be incidental provisions necessary to success.

The local requirements of markets in different parts of Great Britain have been well demonstrated, and these must be observed by exporters, and products adapted to the known demands at the places of destination. As a whole, the British want a butter which is firmer, freer from visible brine, finer and more waxy in texture, and generally better in body than the average "extras" of the American creamery. For export, more time and care should be taken in making and packing butter, and uniformity in product month after month is of utmost importance.

Keeping quality is essential. This involves not only attention to secure good body but also a flavor which shall be rather slow of development and comparatively mild. The quick, high flavor which is so earnestly sought for home trade, although so short-lived and fleeting, is not at all adapted for export. The north of England will accept a fairly pronounced flavor if it be sweet and clean. For London and the south of England the flavor should be extremely mild and almost flat.

Mild, even, slow-maturing flavor is the usual accompaniment, if not the result, of pasteurization and the skillful use of special ripening cultures or of homemade starters in butter making. Hence, pasteurized butter (meaning that which is made from milk or cream which has been pasteurized) is in more favor in the south of England than in the Manchester district. Notwithstanding the extent to which pasteurization has been adopted in Denmark, Ireland, and other countries, the evidence to date is about even for and against the benefits of this practice in preparing butter for the British market. If it costs an additional half cent a pound or more, as estimated, to make butter in this way, there is no reason to believe that this additional expense, as made in America, results in any corresponding gain.

Preservatives other than salt are not prohibited in England, and the use of some form of borax in different food products is very common. A large part of butter which is imported by the British contains some such preservative. But Denmark and Canada furnish important exceptions; there are no chemical preservatives in the butter from those countries. Some British merchants have recommended a moderate quantity of boracic preservative be used in butter sent from the United States. But this Department is opposed to all such preservatives in fresh foods. Thus far nothing of the kind has been permitted in the butter included in the experimental exports, and all who intend to send butter from this country to Great Britain are urged to use no preservative besides salt. In the first place, no such protection is needed to butter well made and properly handled and to be used within thirty days. Next, it will be a misfortune while trying to secure a place for our products in new markets to needlessly create prejudice against them by any action which will give just cause for belief that they are adulterated or contain objectionable ingredients. The dairy products of the United States should be kept strictly pure and free from all forms of so-called preservatives.

The color of butter is permitted to vary somewhat with the season in nearly all the markets of the United Kingdom. Whenever the local supply, however limited, is grass-made butter, a deeper shade of yellow is more acceptable than in winter. Wales wants its butter pretty well colored at all times. London and the south of England

are well satisfied with a moderately yellow article, such as is most approved in late years for the highest grades of butter in the New York market. For the Manchester district, the entire north of England, and Scotland butter of a pale straw color is tinted enough at any season, and in winter it need be no more than a creamy white. In salt there is almost as much difference in taste as in the United States, with a tendency there, as here, to use less and less salt. The best authorities name 3 per cent for the Manchester district and $2\frac{1}{2}$ per cent or less for London and the south. This denotes the salt left in the butter when delivered in market.

For butter packages nothing is now more acceptable in England than the general rectangular or block form, preference being given to the modification by slightly sloping sides, as adopted in Ireland and by the Wisconsin butter box, already fully described. The Danish Kiel, or cask, is equally approved, but simply because it is recognized as meaning good Danish butter. Next in favor stands the cubical box, lately used in Australia and Canada and somewhat in the United States, and the oblong box from New Zealand. All these packages except the Kiel hold 56 pounds of butter, or a half hundredweight, and, as explained, 57 pounds should be packed in this country to insure full weight in the foreign market. The chief objection to the American creamery tub has been sufficiently explained. And it is needless to repeat what has been said in favor of using good parchment linings to packages and coverings to keep them clean in transit. Once convinced, however, that they are offered or have found butter which suits them, British buyers will make no serious objection to the shape, size, or style of the package.

Success will doubtless reward the enterprise of anyone who will export fine butter in pound prints or convenient small packages for delivery unbroken to consumers and press this business persistently in good English markets; but the desired end will be slow to reach. In such an effort proper allowance must be made for shrinkage on every small package, roll, or print. Market laws, which are strictly enforced, require full weight in all commodities at retail.

Export butter should be well chilled, but not frozen, before it leaves the creamery, if to be retailed when two or three weeks old. Then it should be carried to its destination at a temperature held between 31° and 40° F., and care should be taken to avoid any considerable rise in temperature until finally placed on sale.

Before fine creamery butter from the United States is successfully introduced in Great Britain and a permanent demand for it established in the best markets, with full recognition of its merits, there must be a considerable period of persistent effort, during which there will be some unsatisfactory results. English merchants of standing and in control of a reliable high-class trade must be interested in the effort, as has already been done to some extent. These merchants

must be regularly supplied throughout the year with butter uniform in quality and quantity and closely adapted to the particular markets they represent. It must be constantly insisted that the butter shall be always marked, known, and sold to consumers as produce of the United States. In short, States butter will have to be introduced to British markets by vigorous, persistent, long-continued effort, supplying only the best, and always as States butter, just as a place for American beef was made in those same markets. This may be done for butter by private enterprise sustained by ample capital. Or, instead, the examples of Denmark, Australia, and Canada may be followed, and competent, energetic commercial agents of the Government may be kept constantly employed at the principal business centers.

This Department can not establish this foreign trade in high-class butter, or even commence the business upon any truly commercial basis. But by experimental exports like those here reported it may ascertain the conditions to which such trade is subjected and assist in making them known to many who may be interested prospectively, if not at present. Thus far this country has done well in consuming at home practically all of the good butter which it produces. But it is believed that the creamery system is extending so fast that the annual output of fine butter must be increasing faster than the domestic demand. If this proves true, the time is not far distant when a surplus of creamery butter will appear and reliable information as to good foreign markets for this surplus will be in demand.

In order to preserve such reputation as has been already gained in Great Britain for butter from the United States and guard future foreign trade in this variable and perishable product, it will be necessary to provide a system of inspection and marking of export butter at points of export from this country, that purchasers may have the benefit of an official certification as to the purity and quality of the commodity. Foreign buyers are entitled to assurance that the products offered are rightly named and of the kind and quality represented. The want of such an inspection service has left the way open for misrepresentation and fraud and enabled much injury to be done already to foreign trade in the dairy products of the United States.

ACKNOWLEDGMENTS.

Acknowledgments are due to the persons named below, and are hereby made to them, for material assistance given in connection with the experimental exports of 1898-99, and for data which has been freely used in the preparation of this report: Dr. W. H. Wray, resident inspector at London for the Bureau of Animal Industry; Mr. Newton B. Ashby, of Des Moines, Iowa, special European agent for the Dairy Division; Messrs. R. Carter & Sons, butter merchants,

JAMES W. DOWDALL & SONS, E. C. London; Messrs. Dowdall
 & Sons, 10, 11, & 12, Hanging Ditch, Manchester, Eng-
 land; Messrs. J. & M. Mathew, cheese importer, No. 24 Mathew
 Street, Glasgow; Messrs. Andrew Clement & Sons, Limi-
 ted, 10, 11, & 12, Glasgow, Scotland.

APPENDIX I.

EXPORTS OF BUTTER FROM THE UNITED STATES.

Selected and representative fiscal years ended June 30.]

	Pounds.	Years.	Pounds.	Years.	Pounds.
1870	470,440	1870	2,019,288	1891	15,187,114
1871	1,822,341	1871	4,518,844	1892	15,047,246
1872	1,630,538	1872	6,360,827	1893	8,920,107
1873	1,069,024	1873	21,837,117	1894	11,812,022
1874	1,728,212	1874	30,238,038	1895	5,598,812
1875	3,785,093	1875	12,348,641	1896	19,373,913
1876	3,876,175	1876	21,683,148	1897	31,345,224
1877	7,610,914	1877	10,455,651	1898	25,690,025
1878	21,559,892	1878	29,748,042	1899	20,247,897
					Pounds.
					15,034,189
					27,309,800

For the twelve months ended December 31, 1898.....
 For the twelve months ended December 31, 1899.....

APPENDIX II.

TABLE I.—BUTTER EXPORTED FROM THE UNITED STATES BY CUSTOMS DISTRICTS.

Customs districts.	1895.	1897.	1899.
	Pounds.	Pounds.	Pounds.
Baltimore, Md.....	7,524	65,054	84,144
Bangor, Me.....			144,400
Boston and Charlestown, Mass.....	466,269	3,362,613	2,273,507
Brunswick, Ga.....	72		
Charleston, S. C.....			225
Gloucester, Mass.....	400		
New Bedford, Mass.....		50	
New York, N. Y.....	4,402,052	24,024,762	14,034,489
Philadelphia, Pa.....	384	46,525	18,690
Portland and Falmouth, Me.....	1,192	118,321	75,471
St. Augustine, Fla.....	455	62	
St. Johns, Fla.....	1,697	298	1,785
Savannah, Ga.....			1,154
Wiscasset, Me.....			491
Brazos de Santiago, Tex.....	3,108	4,037	4,097
Corpus Christi, Tex.....	20,290	24,833	24,559
Galveston, Tex.....	110		4,030
Key West, Fla.....	155	63	25,703

TABLE I.—*Butter exported from the United States by customs districts—Continued.*

Customs districts.	1895.	1897.	1899.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Mobile, Ala.....	22,963	32,036	55,710
New Orleans, La.....	101,620	128,829	132,300
Paso del Norte, Tex.....	32,945	61,914	62,845
Saluria, Tex.....	8,960	26,002	5,017
Tampa, Fla.....			799
Alaska.....	20	894	607
Arizona.....	1,137	2,878	3,508
Los Angeles, Cal.....		410	50
Puget Sound, Wash.....	35,367	113,676	89,873
San Diego, Cal.....	870	2,479	6,132
San Francisco, Cal.....	333,596	421,191	452,857
Willamette, Oreg.....	30	130	200
Champlain, N. Y.....	25,057	1,062,081	549,981
Detroit, Mich.....	100,045	1,632,504	972,884
Genesee, N. Y.....			35
Huron, Mich.....		607,361	1,033,973
Minnesota, Minn.....	178	196	5,625
Montana and Idaho.....	3,948	1,932	7,486
North and South Dakota.....	30	153	50
Oswegatchie, N. Y.....	19,344	168,100	84,482
Superior, Mich.....	50	16,875	90,576
Vermont, Vt.....	3,005	18,562	283
Total.....	5,598,812	31,345,224	20,247,997

TABLE II.—*DESTINATION OF BUTTER EXPORTED FROM THE UNITED STATES.*

Countries.	1895.	1897.	1899.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
United Kingdom.....	868,815	20,622,410	10,278,788
Germany.....	100,462	2,834,147	918,262
Other Europe.....	333,989	2,658,485	972,801
British North America.....	360,065	1,797,069	1,986,083
Central American States and British Honduras.....	188,330	208,208	250,195
Mexico.....	155,382	218,505	280,924
Santo Domingo.....	84,739	53,051	76,547
Cuba.....	53,305	58,129	585,840
Porto Rico.....	102,914	33,525	45,706
Other West Indies and Bermuda.....	1,956,110	1,984,709	2,065,538
Brazil.....	354,388	318,787	1,420,222
Colombia.....	143,102	132,917	83,351
Other South America.....	626,035	675,295	911,943
China.....	5,528	25,356	22,337
Japan.....	77,001	87,180	92,495
Other Asia and Oceania.....	140,963	150,464	216,882
Africa.....	17,456	15,829	17,147
Other countries.....	21,099	11,069	22,836
Total.....	5,598,812	31,345,224	20,247,997

Red Lion buildings, Giltspur street, E. C., London; Messrs. Dowdall Brothers, butter merchants, No. 32 Hanging Ditch, Manchester, England; Messrs. W. A. McKnight, cheese importer, No. 24 Mathew street, Liverpool, England; Messrs. Andrew Clement & Sons, Limited, 21 South Albion street, Glasgow, Scotland.

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1820.....	1,069,024	1878.....	21,837,117	1894.....	11,812,002
1830.....	1,728,212	1880.....	39,236,658	1895.....	5,598,812
1840.....	3,785,093	1883.....	12,348,641	1896.....	19,373,913
1850.....	3,876,175	1885.....	21,683,148	1897.....	31,345,224
1860.....	7,640,914	1888.....	10,455,051	1898.....	25,690,025
1865.....	21,559,892	1890.....	29,748,042	1899.....	20,247,997

For the twelve months ended December 31, 1898..... Pounds. 15,034,189
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Gloucester, Mass.....	400		
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Philadelphia, Pa.....	384	46,525	18,600
Portland and Falmouth, Me.....	1,192	118,221	75,471
St. Augustine, Fla.....	455	02	
St. Johns, Fla.....	1,697	298	1,785
Savannah, Ga.....			1,154
Wiscasset, Me.....			491
Brazos de Santiago, Tex.....	3,108	4,637	4,087
Corpus Christi, Tex.....	20,200	24,833	24,559
Galveston, Tex.....	110		4,030
Key West, Fla.....	155	63	25,708

TABLE I.—Butter exported from the United States by customs districts—Continued.

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Minnesota, Minn.....	178	196	5,025
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North and South Dakota.....	30	153	50
Oswegatchie, N. Y.....	19,344	168,100	84,482
Superior, Mich.....	50	16,875	90,576
Vermont, Vt.....	3,005	18,562	283
Total.....	5,508,812	31,345,224	20,247,967

TABLE II.—DESTINATION OF BUTTER EXPORTED FROM THE UNITED STATES.

Countries.	1895.	1897.	1899.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
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Germany.....	100,482	2,834,147	918,262
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British North America.....	369,085	1,797,089	1,986,683
Central American States and British Honduras.....	184,330	208,208	230,195
Mexico.....	155,382	238,505	280,924
Santo Domingo.....	84,730	53,051	76,547
Cuba.....	53,905	58,120	585,840
Porto Rico.....	102,914	33,525	45,706
Other West Indies and Bermuda.....	1,056,110	1,984,700	2,065,538
Brazil.....	354,588	318,787	1,420,222
Colombia.....	143,102	132,947	83,351
Other South America.....	626,025	675,295	911,943
China.....	5,528	25,356	22,337
Japan.....	77,001	87,180	92,405
Other Asia and Oceania.....	140,963	150,464	216,882
Africa.....	17,456	15,820	17,147
Other countries.....	21,090	11,056	22,836
Total.....	5,508,812	31,345,224	20,247,967

APPENDIX III.

EXPORTS OF IMITATION BUTTER AND OLEO OIL.

Years.	Imitation butter.	Oleo oil.	Years.	Imitation butter.	Oleo oil.
	<i>Pounds.</i>	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>
1885.....	761,938	37,120,217	1893.....	3,479,322	113,939,363
1887.....	834,574	45,712,985	1894.....	3,898,950	123,295,895
1888.....	1,729,327	30,146,595	1895.....	10,100,897	78,098,878
1889.....	2,102,047	28,102,534	1896.....	6,063,699	103,276,756
1890.....	2,535,926	68,218,098	1897.....	4,864,351	113,506,152
1891.....	1,986,743	80,231,035	1898.....	4,328,536	132,579,277
1892.....	1,610,837	91,581,703	1899.....	5,549,322	142,390,492

APPENDIX IV.

LIST OF CREAMERIES SUPPLYING BUTTER FOR EXPERIMENTAL EXPORTS.

[Name, location, shipments, and dates.]

Hoards' creameries (N), Fort Atkinson, Wis.

Shipments (42 lots, 47,795 pounds): X, XII, XIV, XVI, XVIII, XX, XXII, XXIV, XXVI, XXVIII, XXX, XXXII, XXXIV, XXXVI, XXXVIII, XL, XLII, XLIII, XLIV, XLV, XLVI, XLVII, XLVIII, XLIX, L, LII, LIII, LIV, LV, LVI, LVII, LVIII, LIX, LX, LXI, LXII, LXIII, LXIV, LXV, LXVI, LXVII, LXVIII.

Dates: July 1, 1898, to April 21, 1899.

Albert Lea Dairy Association (L), Albert Lea, Minn.

Shipments (39 lots, 44,403 pounds): XIII, XV, XVII, XIX, XXI, XXIII, XXV, XXVII, XXIX, XXXI, XXXIII, XXXV, XXXVII, XXXIX, XLI, XLIII, XLIV, XLV, XLVII, XLVIII, XLIX, L, LII, LIII, LIV, LV, LVI, LVII, LVIII, LIX, LX, LXI, LXII, LXIII, LXIV, LXV, LXVI, LXVII, LXVIII.

Dates: July 1, 1898, to April 21, 1899.

Iowa College Creamery (A), Ames, Iowa.

Shipments (23 lots, 26,107 pounds): I, II, IV, V, VI, VIII, X, XII, XIV, XVI, XVIII, XX, XXII, XXIV, XXVI, XXVIII, XXX, XXXII, XXXIV, XXXVI, XXXVIII, XL, XLII.

Dates: April 23, 1898, to October 21, 1898.

Bainbridge Creamery, Hovey, Clark & Co. (F), Bainbridge, N. Y.

Shipments (18 lots, 19,764 pounds): VII, IX, XI, XIII, XV, XVII, XIX, XXI, XXIII, XXV, XXVII, XXIX, XXXI, XXXIII, XXXV, XXXVII, XXXIX, XLI.

Dates: June 22, 1898, to October 25, 1898.

E. B. Woodward, merchant (S), New York City.

Shipments (5 lots, 5,541 pounds): I, III, VII, IX, LI.

Dates: April 28, 1898, to July 28, 1898.

Climbing Hill Creamery, De Witt Goodrich (B), Climbing Hill, Iowa.

Shipments (4 lots, 4,560 pounds): II, IV, VII, XI.

Dates: May 9, 1898, to July 1, 1898.

The Manhattan Creamery, A. Jensen, proprietor (E), Manhattan, Kans.

Shipments (2 lots, 2,422 pounds): VI, VIII.

Dates: June 9 and 23, 1898.

The Union Creamery Company (C), Madison, Nebr.

Shipments (2 lots, 2,301 pounds): III, IV.

Dates: May 20 and 27, 1898.

J. G. Turnbull (D), Barton Landing, Vt.

Shipments (2 lots, 2,144 pounds): V, LI.

Dates: June 8 and July 27, 1898.

APPENDIX V.

BUTTER IMPORTS OF THE UNITED KINGDOM.

[For the countries named and for the stated calendar years.]

From—	1886.	1890.	1894.	1896.	1897.	1898.	1899.
	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>
United States	42,390	84,553	20,996	141,553	154,196	60,712	159,137
Canada	31,522	24,318	20,887	88,357	109,402	156,865	250,083
Denmark	400,556	824,749	1,102,493	1,228,784	1,334,728	1,465,030	1,430,052
Other countries	1,069,098	1,094,097	1,421,459	1,579,253	1,619,475	1,520,546	1,550,579
Total	1,543,566	2,027,717	2,574,835	3,037,947	3,217,801	3,209,153	3,389,851

Hundredweight = 112 lbs.

APPENDIX VI.

THE MANCHESTER BUTTER MARKET.

From reports of NEWTON B. ASHBY,

Special Agent, Bureau of Animal Industry.

My opinion is that the Manchester market is a more discriminating market than that of London. It distributes about 6,000 hundredweight (300 tons) weekly of what may be termed North European butters. Of these about 50 per cent are Danish, 30 per cent Swedish, 10 per cent Finnish, 5 per cent Hamburg, 3 per cent Norwegian, 2 per cent Russian. The next most important class of butter distributed is Irish butters, divided into two classes—Irish creameries and Irish firkins; the latter divided into Salts and Milds. These Irish butters find a market only during certain seasons of the year. In addition there are Canadians and States, and, in a very minor way, Colonials. The supply of States butters has been largely drawn from cold stores butters and creamery butters not of the highest grade.

CLASSIFICATION.

Danish butter may be called the "staple." In a general way, it is divided into three classes—Contract Dairy, Choicest, and Choice. Contract Dairy is estimated to reach 10 per cent of the total Danish butter distributed from Manchester; Choicest, 70 per cent, and Choice 20 per cent. Contract Dairy is contracted to the trade by the dairies or their agents in advance at prices ranging from 1s. 6d. to 2s. above Copenhagen official quotations. Choicest Danish is the butter quoted in the Copenhagen quotations. Choice Danish is a grade about 6s. lower on an average than Choicest Danish.

However, Choicest Danish divides itself in the Manchester market into about three grades, and in practice only about 10 per cent of this butter brings the Copenhagen price plus the addition of freight, etc.; 70 per cent of Choicest will grade at 2s. to 4s. below top prices, and the other 20 per cent, again 2s. lower. The best Swedish butter equals the best Danish and brings as much money, but, in a general way, the Swedish supply may be estimated at 2s. below Danish Choicest. The Finnish supply is not uniform in quality even in the better grades, and the prices realized for it may be estimated at 6s. to 8s. below Choicest Danish. Hamburgs in scarce times sometimes command more money than Danish, but in a general way, may be said to be 4s. lower. The Russian supply will grade about with Cork thirds. The Canadian butter, say for about four months, during the flush grass season, comes in at the rate of 500 packages weekly, and divides itself into two qualities—Canadian Best Fancy and Canadian Ordinary. The Canadian Fancy often sells nearly as well, if not quite, as best Danish, but would probably grade about with Choicest Irish Creamery. They are especially well received

when the Danish are a little stiff in price. The Canadian Ordinary would probably grade about with Irish seconds. The States Creameries in Welsh tubs grade about as Canadian Ordinary.

The reasons for the great ascendancy of Danish butters in Manchester and district and north of England markets are as follows: The Danes have devoted themselves to making a butter of uniform quality. They have catered to the English taste and have succeeded in educating these markets to accept their makes as standard—in color, salting, texture, and preparation of packages. Another cause is the regularity of shipments and the certainty of receiving consignments at regular, fixed dates. Boats engaged in the butter trade ply, at fixed dates, from Danish to English ports, and the times of arrival can be relied on with certainty. Butter leaves the Danish ports Friday and is in the English market the following Tuesday. For these reasons the wholesale trade, as well as the retail, cooperate to keep this butter on the market, and while they possibly have no feelings of hostility to trade from any other source they, at the same time, do not feel the same motives of personal interest in other supplies.

The objections to Irish creamery butters are: (1) That it is only rarely the body of the butter (as it is called) is equal to that of Danish; (2) that the supply is only for a portion of the year, and then not uniform; (3) that the Irish creameries, as a rule, do not exercise sufficient care in packing and with character of packages. The objections to Irish firkins are lack of uniformity in character, not always strictly cleanly in make, and very badly packed and very often in bad cases. I note, however, signs of Danish butter losing its superiority as a standard. In the first place, I learn that there is now more disposition on the part of dealers of all grades to accept butter on its quality rather than on its origin, and to pay practically as high prices for Irish Creameries or Canadians, for instance, when quality is equal, as for Danish Kiels. In the second place, I find that in the higher grades of the retail trade some of the stores receiving the highest price paid are now selling nothing but Swedish for their top butters. I assume that the reason for this is that the Danes rely upon the supremacy they have gained and do not take the same pains as they did when establishing their markets, and, on the other hand, the Swedes are taking every precaution to have their best butters of very superior character. For this reason I am of opinion that the time is auspicious for any country which desires to make experiments with their superior grades of butters to get a fair hearing in the Manchester markets.

There seems to be no prejudice against the butter from the United States per se. But it is said almost generally by dealers that they would not offer it to their customers for the reason that the butter so far offered from this source has not been of a kind to meet the wants of their trade, and that their customers are prejudiced against it because they believe the quality to be inferior. The manager of a prominent house told me that if the butter from the United States were placed on his counters alongside of Danish butter of similar quality very few of his customers could be persuaded to take it, as they would not believe that it would be as satisfactory as the Danish.

The more I see of this district the more I am impressed with the possibilities of trade development here, and the advantages that would accrue from having an agent permanently located in Manchester to cooperate with the trade here and at home in strengthening the commercial relations of the two countries. I meet the complaint that the exporters from the United States are not awake to the importance of catering to public taste in details. Some States butter merchants, however, are spoken of highly as exceptions to the general rule. To secure a fair share of the British trade there will have to be organization from the farm to the consumer. It will be necessary to study the foreign tastes and cater to them in detail. The effort should not be one of a day or a year, it should belong continued and conducted with patience, push, and energy, and should be well supported with capital.

REQUIREMENTS OF THE MANCHESTER MARKET.

QUALITY.

Sweet and fresh flavor, waxy texture, good grain and body. I understand by this a butter that is solid and firm to pressure and without oozing water. There should be not less than 12 per cent or more than 15 per cent of water. Too little moisture kills flavor and too much renders the dealer liable to prosecution.

COLOR.

A pale color is preferred and in fact demanded for all first grades. The color may range from a very pale straw or creamy white to almost the whiteness of good lard. One commission house insists on pale butter, and their representative says "the paler the better," but he admits that if quality and flavor are all right the color is of only minor importance. It is possible, however, to have the butter too light. In one instance lard-colored butter was offered at 11d. and other, supposedly no better but of cream color, was quoted at 1s. A butter salesman said the customers prefer the cream-color butter to the light butters at 1d. extra per pound. Light color is tolerated much better than deep yellow or orange tints. These deeper colored butters find no market except among the poorer classes who "want butter rich enough in color so they can see it on their bread."

SALT.

First-grade butters should contain from 2 to 3 per cent of salt—say an average of 2½ per cent. The salt should be thoroughly worked in, and more than is needed should not be put in to be reduced to the proper amount by washing. One dealer put special stress on the fact that the Manchester market does not want a saltless butter. It wants salt, but in moderation. His receipt is to wash out the butter without salt, leaving a fair degree of moisture in the butter, then work in five-eighths of an ounce of salt to the pound of butter.

PACKAGES AND PACKING.

Kiels¹ are preferred, as this style of package has become synonymous with good

¹ The Kiel is a favorite package, and it is used for all Danish and north European creamery and dairy salted butters. The term "Kiel" originated from the German port of same name, where this form of package was first used for export. It is the custom to speak of both the keg and its contents as "Kiel," but reference is had to shape and nothing more; the quality or source of the butter is not necessarily designated by the name of the package. The Kiel keg tapers slightly and uniformly from center to each end. It should contain 112 pounds of butter. Measurements of three Kiel kegs, (1) and (2) Danish, (3) Finnish, are as follows:

	(1)	(2)	(3)
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Diameter of top, outside	14	13½	13½
Diameter of top, inside	13½	13½	13½
Diameter of bottom, outside	14	13½	13½
Diameter of bottom, inside	12½	13	13½
Diameter of center, inside	15½	15½	15½
Circumference, ends	44	44	45
Circumference, center	53	50½	53

Height, about 28 inches.

Of course the measurements of perfect Kiels would always be the same. They are made of beech staves and beech or elm heads and bottoms and willow hoops. The Danish are the better casks, and probably cost about 2s. 3d. each in England. I believe the Dutch cost, made up in Ireland, about 1s. 6d. each.

The general custom in stripping the Kiel is to remove hoops from head and center and spread staves till the butter drops out, thus exposing the contents for sale in the original shape. Some retailers who have a small wholesale trade also will cut the package into two or into any sizes desired, from 10 pounds up, for the convenience of the small shops with which they deal. As a rule such trade is in the lower grades of butter.

butter. Butter from Kiels sells at retail at an advance of 1d. a pound because people have come to associate good butter with the Kiel shape. The manager of a large number of retail stores told me that he had frequently made the experiment of cutting a Kiel in halves, and always with the same result, namely, reduction in price of 1d. per pound. And this is confirmed by the wholesalers. My own observation has been that while a majority of dealers say that the Kiels help to sell the butter because consumers think only first-class butter is put in these packages, yet first-class butter in other shapes brings first-class prices, and if such butters were put upon the market continually in another package the prejudice as to shape would disappear.

On account of the convenience of the 56-pound square packages and because of the fact that Canadians and Colonials and States have become familiar in this form, some of the trade are anxious that they should be persevered in. I examined a box of butter that was approved. It was rectangular and tapered slightly from bottom to top. It was made of white wood and fitted with a double top, the inner part of which might be termed a false bottom. The butter was carefully surrounded with white parchment paper. Special attention was called to the importance of using a good quality of parchment paper for box linings. The heavy papers cost more, but it pays to use them. In general it may be said white woods are preferred for making the boxes and they must be of a character not to impart odors to the contents. For long distances it will doubtless pay to cover the packages with canvas, which keeps them clean and prevents dust from working through the joints at the ends.

These points may be summarized as follows:

Quality.—Sweet and fresh, waxy texture, moisture 12 to 15 per cent.

Color.—Light straw or creamy white.

Salt.—Two and one-half per cent.

Packages.—For the United States, 56-pound slightly tapering, lined with heavy white parchment paper and covered with burlaps or canvas.

CHARACTER OF TRADE.

In Manchester and district the great body of consumers catered to belong to the manufacturing classes. Most of the business of retailing butter is carried on by the grocery houses, and in many cases butter is made the leader and the retail prices cut to a point which yields but a narrow margin of profit. A great deal of the business is carried on through cooperative stores. These stores perform almost every function in the matter of catering to the public except producing the provisions themselves. In addition to serving as purveyors in almost all classes of goods, they conduct their own butchering establishments and their own bakeries. Many of the other groceries are managed by huge limited companies, conducting sometimes as many as fifty stores scattered throughout the district. Some of these cooperative stores and limited stores turn over an immense sum weekly. For instance, I was told by the head of the provision department in the cooperative stores at Bolton that their weekly sale of butter amounted to about 25 tons. The manager of the cooperative store at Pendleton (a suburb of Manchester) told me that their weekly sale of butter would average at least 180 hundredweight. I presume that the turnover of butter in all of these large cooperative stores and large limited stores conducting a number of branches would fall somewhere on an average between the extremes I have mentioned—that is, somewhere between 9 and 25 tons. In addition to these large cooperative stores and large limited stores there are men in smaller business who have under them two, three, or four stores, who probably sell a ton and upward of butter per week. There are others who carry on a retail trade and a small wholesale business, wholesaling to smaller shops in the poorer quarters, which buy in 12 to 20 pound lots. Most of this trade is in the inferior grades of butter, and I have given but little attention to it.

The trade of the large stores varies in accordance with the districts where their stores are located, some stores requiring a higher class of butter than others, and the retail price varying with the grade of butter. In the best trade the best Danish or best Swedish is kept as the first butter and retailed at a range of from 11d. to 1s. 3d., very rarely, as I learned from a great number of interviews with different stores, reaching as low as 11d. or running as high 1s. 3d. In rare cases I found the range of prices above these figures, say from 1s. to 1s. 4d., with an average of about 1s. 2d.; but these cases do not represent the average of the trade. In a lower class of trade Danish seconds and butters of about that grade, are kept as firsts, and retailed from 10d. to 1s. 2d., with an average of probably 1s. In a still lower grade of trade the Dutch are the best butters kept, and the firsts are retailed from 9d., sometimes as low as 8d., up to 1s.

The higher the class of trade the more particular customers are as to color, salting, flavor, etc., and, as a rule, only pale butters are to be found in the best class of trade.

In some of the manufacturing districts there is a demand for Irish salt butter, as the population want butter that has enough salt to give flavor to their bread. I am told, however, that this trade in salt butters is a decreasing one and that the tendency of good butters to bring low prices during the whole season has cultivated the tastes of the manufacturing population for higher grades of butter.

METHODS OF SALE.

First are the wholesalers who endeavor to handle as much of the butter trade as is possible, and to do this so far as is possible on a commission basis. In Manchester, however, the Danes have very largely broken into the wholesale system and compelled wholesalers to modify their system to meet the exigencies of the case. The aim of the wholesaler is to sell everything on consignment. On the other hand, the attempt of the Dane is to compel the wholesaler to sell at contract prices. While the Danes have succeeded in this in a measure, this work has also resulted in placing them more at the mercy of the markets. There are certain grades of butter demanded in Manchester market, in order to secure which wholesalers find that they must contract in advance, at prices ranging from 1 to 2 kroners above the Copenhagen official quotation. This butter is known as contract dairy, and wholesalers buy no more of it than their trade relations absolutely demand. The next grade of butter is Danish Choicest, which is the butter quoted at Copenhagen, and the Danes on their part endeavor to keep this class of butter in the Manchester markets at Copenhagen quotations plus freights, discounts, and commissions amounting to about 8s. per hundredweight, as these various items are usually figured. My observation, however, is that the Danes do not succeed in securing these differences, and in the present condition of the markets my opinion is that they do not realize in the Manchester market an average of Copenhagen quotations for Choicest.

Next under the wholesaler in importance come the cooperative stores and large limited retail stores which I have mentioned, and which may be regarded as wholesalers in so far as supplying the wants of their own catering trade is concerned. I find that all of these stores pursue the policy of buying direct through agents in Denmark and Sweden, or direct from the factories, or through the Manchester wholesalers, as the outlook of the markets seem to promise best. When the conditions of the Manchester wholesale markets are such that there is an opportunity of buying to better advantage in Manchester than to buy direct from the dairies in Denmark or Sweden or through the agents at Copenhagen or elsewhere, they go into the wholesale markets. Many of these large stores have standing orders with Danish agents for fixed amounts of butter weekly, prices based on Copenhagen quotations. This means, however, as I have come to understand, Copenhagen

quotations compared with what is realized for the butters consigned for sale to Manchester and north of England markets. As I have stated, my conclusions are that the butters on an average are delivered to these stores for less than the Copenhagen quotations. The Danes, however, have carried their system of direct sales a great deal farther than direct dealings with cooperative stores and large limited stores. They have sent their agents all through England, and wherever they find a man in the butter business who can take even as little an amount as 2 Kiels a week, they establish direct trade relations with him if possible. The result of all this is that there is a continual struggle between the wholesalers to control the trade and the Danes to deal direct; the result, in my observation, being for the benefit of the retail trade and to the damage both of the wholesalers and the Danish factors and producers, as the retailer is continually engaged in working the wholesale market in Manchester against his direct imports, and vice versa. For instance, I have had managers of stores tell me that they have the option of certain quantities in the Danish markets every week subject to the official quotations at Copenhagen. Whenever they find that they are likely to be able to buy good butter to better advantage through the wholesale markets in Manchester, they immediately telegraph canceling their Danish order for the week. Of course the tendency of this is to induce the Danish agent or factor to cut his price, and this again reacts in lowering prices all around.

A brief mention of some features of the retail butter business, as carried on by many merchants, may be of interest. The chief butter market of Manchester is held on Tuesday, and the retailer aims to purchase on this day the week's supply. It is not the custom, however, to expose the butter bought on Tuesday for sale until Friday morning following, as the chief retail days are Friday and Saturday, and the aim is to have the butters freshly turned out on the mornings of these days. If one should step into a large retail butter store on Friday or Saturday morning, he would see turned out on the butter counters anywhere from 6 to 10 hundredweight of butter in the original boxes in which packed for market and probably consisting of three grades, differing in price a penny per pound, as between each grade, say 1s., 11d., and 10d. What is left over from Friday and Saturday is expected to meet the demand for the rest of the week; but should this demand be greater than expected, then the dealer must begin to draw on the Tuesday's purchases before Friday, and in that case he will give a supplemental order at the small market on Friday.

One delivery answers except in cases of supplementary buying, in which cases special delivery must be made. The butter is sent direct from the warehouse of the wholesaler or agent to the store of the purchaser, and where sales will permit direct from the port of entry or landing. For instance, if a Manchester house received a cargo of butter at Liverpool which had been sold in advance of arrival, this butter would be distributed direct from Liverpool to their customers without passing through their warehouse at Manchester. Cold storage is not employed in the current butter trade. As a rule, butters are put in cold stores only when they are to be held for an indefinite period and never when the butters are for consumption during the week or fortnight. If A has a retail trade requiring an average of 25 tons a week, he buys on Tuesday's market 25 tons. This is delivered to him from warehouse or port of entry that evening or next day. He places it in a cool room or ordinary storeroom, just as his facilities may be, until Friday morning, when as many packages are opened as the butter counters will accommodate, and as packages are sold out new ones are put in their places. Hence, the conditions to which butter are exposed vary with every dealer, but in a general way it may be said that butter is exposed to the ordinary climatic conditions which may prevail at the time for from five to seven days. Customers are served from the original package, the butter being cut from the mass and made up under eyes of purchaser.

MARKET QUOTATIONS.

I have already sent to the Department tables¹ showing the mean monthly aver-

¹ *Average monthly market prices, per hundredweight, of butters at Cork, Ireland.*

[Prices given for each month are the averages of highest and lowest. For Manchester prices about 8s. per hundredweight should be added to cover freights, commissions, etc.]

FIRSTS.

Month.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January.....	132 0	129 0	129 0	129 0	125 0	100 0	118 0	114 0
February.....	125 6	122 0	113 6	107 8	93 0	100 0	108 0	100 6
March.....	120 0	123 6	105 0	98 6	78 6	87 6	79 0	79 0
April.....	109 0	106 6	95 0	81 0	98 6	79 0	78 6	73 6
May.....	88 0	85 6	83 0	80 0	72 6	75 6	75 6	75 6
June.....	78 6	81 6	85 0	89 6	80 0	84 6	80 0	84 6
July.....	73 6	85 0	93 6	99 6	79 6	87 0	83 6	83 6
August.....	79 6	91 6	96 0	103 0	76 0	80 0	84 6	80 0
September.....	87 0	103 6	103 0	104 0	80 0	86 0	87 0	84 6
October.....	97 6	106 6	109 6	105 0	78 6	104 0	99 0	83 6
November.....	111 6	112 6	114 0	115 6	87 6	107 0	102 6	85 0
December.....	122 6	123 6	118 0	120 0	102 0	110 0	107 0	99 0

SECONDS.

Month.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January.....	124 0	118 0	114 6	114 6	94 6	106 0	106 6	106 6
February.....	117 0	120 0	97 6	111 0	100 0	106 0	100 6	100 6
March.....	114 6	115 0	90 0	99 6	80 6	93 0	89 6	89 6
April.....	98 6	96 0	81 6	86 6	62 6	75 6	79 0	79 0
May.....	77 6	78 6	84 0	81 0	78 6	70 0	73 0	73 0
June.....	74 0	78 0	82 6	86 6	76 6	71 6	71 0	71 0
July.....	68 6	83 6	90 6	96 0	73 6	74 6	71 0	71 0
August.....	72 0	97 0	93 6	96 0	73 0	76 6	82 0	76 6
September.....	77 0	109 6	99 6	109 0	75 0	83 0	82 0	80 0
October.....	86 6	101 0	101 0	100 0	71 6	101 0	87 0	78 6
November.....	95 6	100 6	96 0	102 0	71 6	94 6	84 6	73 0
December.....	108 0	110 6	107 0	108 0	79 0	93 0	94 6	85 0

Average monthly prices (in Danish kroner) per hundredweight, of butter at Copenhagen, Denmark, 1880 to 1898.

[One kroner = 13.50d. = 27 cents. One hundred kroner per hundredweight = 112s. per hundredweight = 24 cents per pound. Although Manchester price would be expected to be above Copenhagen quotations by about 8s., this is not the case in practice. A considerable part of the Danish butter sells for less than quotations.]

Month.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
January.....	122	131.5	135	121.5	120	114	104.5	102	98.5	105
February.....	124	128	133	124.5	125.5	104	99.5	93	95	107.5
March.....	130	117.6	130.4	129.8	113	106	94.5	97.2	96	103
April.....	123.6	114	121	102.5	106	96	84.4	84	82	87
May.....	97.5	106	90	100	91.4	85	81.5	74	76	84.5
June.....	98	103.8	98.4	97.5	90	82.5	73	78.6	84.5	84.5
July.....	102.6	110.5	101.5	101	91.6	89	83.6	91	84.5	91
August.....	109	115.5	103.6	104	102.5	96	88.5	99	84.4	91.4
September.....	117.6	119.2	113	107	113	106.5	98	102	100.5	92.5
October.....	125.6	128	119	117.5	125	113.6	108	108	99	97.6
November.....	138	135	124	125	117	100	107	107.6	99.6	102.5
December.....	131.6	134.8	125.5	124	116.5	104	108	100.5	100.5	105

Month.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
January.....	97	102	112	97	95.5	100	96	98.5	92.5
February.....	97.5	98	107.5	90.8	91.5	93	98	94	94
March.....	96.5	104	103.2	90	89.2	86	93	89	90
April.....	91.5	91.4	90	84	81.8	82	81	83.4	85
May.....	83	78	90	76.5	73	79	74.5	79.5	79.5
June.....	75	78	83.2	86.6	69.7	73	79.5	79.5	79.5
July.....	73.6	84.5	85.5	95	71	83.5	82.6	82	82
August.....	83	88	85.5	85.2	75.8	87.4	97	88	88
September.....	94	95	97	104	83.5	95	96.5	96	96
October.....	110	107	107	101.5	86	109.4	104	93	93
November.....	107	109.5	107.5	105.6	109	98.5	98	97	97
December.....	104	114	103	94.5	90	98	100	98.5	98.5

age of the official quotations for Irish butter from 1890 to 1897 and for Danish butter from 1880 to April of 1898, and it is not necessary for me to repeat these average monthly prices in this report. I should mention, however, that the Copenhagen system of quotations was modified November 1, 1894, and that to put the official quotations previous to that date upon a basis of comparison with the present system of quotations, from 7s. to 8s. per hundredweight should be added to the quoted price previous to November 1, 1894.

The only value of these tables is in comparing one year with another, and also serving as a sort of guide to what the same grades of butter bring in the Manchester and north of England markets. If they were absolutely what they pretended to be, f. o. b. prices at Copenhagen and at Cork, they would be close guides for determining prices which one could reasonably expect to receive net for any grade of butter taken. A better guide, however, will be, as facts are, retail prices. I think from my investigations that it is safe to figure that retailers receive on an average during the year 1s. 1d. a pound for the classes of butter grading as Danish choicest. I figure that this is a fair average from the fact that in the cheaper seasons, say a month to six or eight weeks, they run down to 11d., and for a like period during the scarcer season up to 1s. 3d., general range, however, being from 1s. to 1s. 2d. As previously explained, butter is handled on rather a narrow margin in Manchester markets, the competition being strong and it being used as a leader for their trade. But for all this the retailer or the manager of stores would consider himself not living up to his calling if he did not make some profit out of this trade, even at its worst. I am not prepared to speak absolutely, but my opinion is that the trade in first-grade butter is conducted so as to secure an average from 15 to 16½ per cent of profit on the gross cost. On lower grade butters probably a little higher profits are realized. I am of opinion that if our dairies and creameries propose to cater to Manchester and districts and north of England markets in a serious way, they should propose to cater only to the best markets, aiming to secure first prices or, at the worst, second grades. Hence for any season in the year, if we take retail prices in Manchester, allow the retailer from 15 to 20 per cent on the gross cost of the butter delivered to him in Manchester, then take off freight, insurance, discount, and commission we will be very close to what our creameries could reasonably expect to receive net for their product, whether of first or second grade. If we take the average for the year for first-grade butter at 1s. 1d., this would give the gross price in Manchester 121s. 4d., allowing the retailer one-sixth of this, or say 20s. 4d. for his profit, we will have left 101s. (nearly 22 cents per pound) as the average price for the year to be realized by our creameries, out of which must be paid all of the costs of putting the butter into the retailer's shop. It is just possible that the retailer's profit might be reduced to a point 4s. or 5s. below this, but I think the other the safer average to figure upon, and for second-grade butters an average of about 8s. less might be taken as a safe basis. Should our creameries later on conclude to make an effort to secure a share of the Manchester and district trade, it is through the cooperative stores and the large limited retail companies that our trade is most likely to succeed and develop rapidly. Our first work will be to satisfy them that we can supply them fixed quantities of uniformly good quality. When the grade of United States Creameries has been established and it has been shown that dealers can rely upon the grade being maintained, and can also rely upon regular shipments reaching them on fixed dates, there will then be no difficulty in establishing sales direct to the retailers and in large quantities. Until that time we shall have to rely upon the wholesale trade to push our trade and make the grade and quality of our goods known.

DIFFICULTIES.

I find that I encounter certain difficulties in carrying out the Department's instructions regarding tracing of goods to consumers, and getting opinions of con-

sumers as to quality, etc. In the first place, the work of the Danes in endeavoring to supplant the wholesale trade and deal direct with retailers, even retailers in a very small way of trade, renders the wholesalers suspicious of the motives and designs of our Department, and they object to giving the names of retailers to whom consignments are sold. However, in our case, this objection has been waived in some instances. It is understood that I shall visit, in so far as practicable, the retailers to whom our butters go and see the same on their counters, etc. The second difficulty is even more grave than the first, namely, to get opinion of consumers. I have asked retailers if they would secure this information for us and in every case have met with refusal. Their contention is this: If the consumer is not satisfied with butter he will complain at once and will have no more of it; if he is satisfied he says nothing, but buys again and again until finally he begins to ask for the same brand. The grocer says that the consumer looks to him as retailer to secure and keep good butter and that if he asked a consumer for an opinion as to quality or grade, the consumer would at once conclude that there was something wrong with this particular butter, and would be prepared to reject it on grounds of general suspicion. I am led to the opinion from my observations and investigations that the individual opinion of consumers has not as much weight or practical value for us as the opinions, first, of wholesalers as to quality and class, and, second, of retailers as to how our butters will grade in their trade and suit their demands. I have the promise of a number of leading men in the large retail trade and of managers of cooperative stores to come and examine our samples and give me their opinions. I have found a very cordial reception from all grades of the trade, and I think the wish is very general that our work may prove so successful that our butter will become a competitive factor in the Manchester market.

In this connection it is interesting to note the following official report regarding Manchester as a market for Australian produce, as published in the *Grocers' Review*, December, 1899:

MANCHESTER AND AUSTRALIAN TRADE.

Hitherto the great bulk of Australian produce has been sent direct to London, and has been distributed from that center. The large consuming markets in the north of England have been more readily supplied through Liverpool, Hull, and Newcastle—the natural ports for imports from Canada, the States, and Denmark and other Continental suppliers. As a consequence, Australian produce has admittedly not received the attention it deserves. * * *

The railage to Manchester and the London agents' commission proved too heavy a handicap for the Manchester buyer, and he could not compete with our established rivals—America and Denmark. There can be no doubt that existing arrangements prevent the best qualities of our products from leaving London, and this must be altered if we are to make any impression on the Manchester market. It requires the very best quality we can send. The Canadian and States shippers, with the assistance of their respective Governments, are working hard to consolidate their position; while the continental exports find a ready sale. A strong desire among Manchester traders to get into closer business relations with the Australian producer was observed. There is a tendency on the part of the continental shippers to cut profits down, but the traders are in favor of giving the Australians a chance if they will send goods of suitable quality at fair prices. It is apparent that with a direct service it will be possible to attain at least London prices, and to open up a large business in districts where a good and fair-priced article is appreciated, and where, hitherto, our products have been

excluded. A direct trade between the north of England and Australia would be largely a reversion to the ordinary order of things.

The population of which Manchester is the center amounts to about 3,000,000, or, including the districts which Manchester is the nearest port, some 7,000,000. This is about one-fifth of the population of Great Britain, and the greater portion consists of people of the working classes, who are large consumers of food supplies such as Australia produces. The usual method of distributing food products is by means of a provision exchange; the Manchester market day is Tuesday, and large buyers come in from all the surrounding towns to visit the exchange and warehouses. * * *

These people require to be catered for differently from those in London. As a rule, the wife of a Manchester man is employed in the factory along with her husband, consequently she has little time for cooking, and falls back on the use of tinned goods; about two-thirds of the tinned goods imported into England are consumed in the north of England. The reason for the liking of pale butter is that when the Danish first came onto the market (being a winter make, with stall feeding) it was pale, and being much superior to any other class on the market at the time, pale butter and good quality became associated. To make an impression on this market exports in this color are essential.

APPENDIX VII.

BRISTOL BUTTER MARKETS.

By NEWTON B. ASHEY,

Special Agent, Bureau of Animal Industry.

Bristol is situated in the heart of a fine agricultural region devoted to cattle growing and dairying. From about the middle of May to September the butter markets of Bristol and district are largely supplied from home produce, and trade in foreign butters is consequently of small volume. The consumption of foreign butters during the other eight months of the year is of considerable magnitude. The supply is Irish, Canadian, United States, Australian, and Danish. The last named has very little foothold and does not dominate the market as in north of England. Irish Creameries may be said to fix the standard for best butters. The Bristol wholesale butter merchants find their market in Bristol and the region in a radius of 50 miles, as local railway rates is a bar to competition. Their best trade, as I gathered, was with South Wales.

Bristol and district require pale butter, say a cream color. They do not want the lard color, which is in demand at Manchester, nor the dandelion-yellow, which is in favor at London. In salt they take a little more than either London or Manchester; want the butter, in fact, to have a smack of salt, say about 3 per cent. The square box of 56 pounds is preferred, but no special prejudice exists against tubs, and butter of equal quality in tubs will bring as much money as if in boxes. The 70-pound tub is preferred to the 60-pound. This is the only district in England where I have found no prejudice against butter in tubs.

I learned that considerable Elgin creamery butter was marketed during last season in Bristol and district and was well liked. Some of it commanded equally as good prices as top Canadian and Irish Creameries, but the greater part brought about a half penny (1 cent) a pound less, or 4s. 6d. per hundredweight of 112 pounds. The Bristol wholesalers prefer to buy butter, c. i. f.,¹ and follow this practice with butters of known uniformity of quality. They also sell on consignment, charging 3 per cent on gross sales. Warehousing charges, etc., are computed to amount to about 10s. on the ton.

¹ Cost, insurance, and freight paid.

The chief cold stores are controlled by the docks committee, and they have ample cold stores in both Bristol proper and at Avonmouth, the chief port.

Charges for cold storage in Bristol.

Products.	Per ton per week for first two weeks.	Per ton per week there- after.
Charges from April 1 to October 31:	<i>s. d.</i>	<i>s. d.</i>
Butter	5 0	3 6
Cheese	3 6	2 6
Eggs	5 0	3 6
Charges from November 1 to March 31:		
Butter	4 0	2 6
Cheese	3 8	2 0
Eggs	4 0	2 6
Bacon and lard	3 6	2 0

NOTE.—All the above on net weights.

The rates on butter, cheese, eggs, lard, and bacon, in case of Bristol, cover cost of housing and unhousing, and at Avonmouth putting on rail and starting to the railway company's sidings.

When in Bristol, June 29 and 30, Welsh tubs (imitation) were worth 64s.; Creameries (Welsh tubs), 80s. During season of 1896 Canadian and Irish Creameries touched as high as 120s., but during the season of 1897 only from 98s. to 100s.

I am of opinion that as good results could be secured in Bristol and district with our butter as at Manchester or London, and undoubtedly better with Welsh tubs.

APPENDIX VIII.

NOTES ON LONDON BUTTER TRADE.

By NEWTON B. ASHBY,

Special Agent, Bureau of Animal Industry.

In many respects the details of the business of the retail butter dealer in London are conducted in the same manner as in Manchester (see Appendix VI, p. 201); but in London there is no regular butter market, as in Manchester. The principal buying by retailers is on Monday and Tuesday, and for the rest of the week the buying is only supplemental.

Our butters have been distributed widely among the London trade and are now beginning to be called for by regular customers. They are regarded as being next in quality to Choicest Danish, and now command better prices than other butters in competition except the Danish. By keeping up the standard of excellence I think we may reasonably anticipate to realize within a cent a pound of Choicest Danish and, in time, prices equally as good. I trust that the work in London may be continued and the amounts shipped gradually increased. As a matter of preparing for further trade, it would seem to me that groups of creameries should be organized for manufacturing a fixed quantity each week for export to the English markets, irrespective of New York prices, provided net prices realized in England left a profit on cost of manufacture. I feel quite sure that such work would bear abundant fruit in the near future. If we do not take hold now and secure a reputation for our butters, the field will soon be occupied by others, whose product we will find it difficult to displace, once they have established themselves. I feel con-

fident that, with proper care and attention to all the details of manufacture and shipment, we can have a good share of the business.

In this connection the following extract of a letter from a leading London commission house is of interest: "It does not matter that a certain make or description [of butter] is withdrawn from our markets for a time; for example, we get hardly any Colonial butter from the end of April to the beginning of October, yet the trade is always ready for them on their first arrival. This is because quality is good and prices lower than any other description then offering. The make of butters the States will have to compete with, if they send during the summer months only (and this we should suggest), are those from Ireland, Holland, Denmark, Normandy, and Canada, and the best of these are from Ireland and Denmark. Butters chiefly in demand during different parts of the year are as follows:

"January to March: Danish and Colonial,

"April to May: Danish, Dutch, Normandy, and a few Colonial.

"June to September: Danish, Irish, and Normandy.

"October to December: Danish, Colonial, Dutch, and Normandy.

"We also have Canadian butter, but not to any appreciable extent.

"The prices vary considerably, according to whether the season is a dry or wet one, the latter, of course, being best for the make of butter; but you may take it that finest Irish is worth about 84s. and Denmark about 94s. during the months of June, July, and August, and a slight advance in September of from 5s. to 10s. per hundredweight, and we should think about 84s. would be the price for finest American butter during the first three months named. It is most essential that shipments should be made regularly once a week if possible during the season. We get Irish two and three times and Danish twice a week. We write respecting salt butters only, not fresh."

UNSALTED BUTTER FROM FRANCE.

A large proportion of the highest priced butter sold in London is from France and contains no salt. It is called "Fresh" or "Brittany Fresh," the term "Fresh" meaning unsalted. All of this butter is in 2-pound rolls, in which shape salted butter, with the exception of a little English farm butter, never appears. It is collected from the farmers and graded at a factory into four grades and each grade is blended into homogeneous form. Hence in the market they are known as "Factory Blended." The fresh butters are sent to the London market in boxes usually containing 12 rolls of 2 pounds each. The boxes are made of white inodorous wood, one-quarter inch thick, planed inside and unplanned outside. Their inside measurements are, in inches, depth 6½, width 9½, and length 12½. The rolls are placed on end in three rows of four each. The boxes are lined with white paper having fancy border. Inside of this comes a thin muslin cloth which incloses and covers the butter as a whole. The individual rolls are not wrapped. A small proportion of the butter is shipped in baskets containing fourteen 2-pound rolls.

The four grades of butter are usually distinguished by the color of the address marks. For example, a shipment to London is marked with the initials of the firm to whom sent, and if these are in black they might represent "first grade;" red might mean "second grade," etc. In addition, the box bears the name, address, and trade-mark of the shipper.

The agents for these butters are now (June 23, 1898) paying for them the following prices: First grade, 24s. per box of twelve rolls (25 cents per pound); second grade, 22s.; third grade, 20s.; fourth grade, 17s. It is the practice to make a difference of 2s. on the 24 pounds (2 cents per pound) between each of the three superior grades, and of 3s. between third and fourth grades. The agent sells to the retailer

at exactly the same prices he pays, namely, at present 24s., 22s., 20s., and 17s. The shipper gives the agent a rebate, which makes his profit. Whether this rebate varies in accord with quantities sold I do not know, nor do I know just how much the rebate is. It would seem to differ from a commission business in the one important detail that shippers by this means keep control of selling price, which they could not do in case of consignments. Such a plan of sale is only possible, of course, under very peculiar circumstances. First, an article of well-known uniformity of grade; second, the business in the hands of only a few firms, who control supply. In October, November, and December of 1897, the prices reached 30s. to 31s. per box of 24 pounds, first grade. I am told that these were about the extreme maximum prices, while present prices are minimum.

These first-grade butters are now retailing at 1s. 2d. to 1s. 3d. per pound, so the retailer is situated to get 2d. or 3d. profit per pound from his customers. In case of the cost reaching 30s. to 31s., he gets 1s. 5d. to 1s. 6d. per pound. I find the London retail seller of butter wants a minimum profit of about 2d. in pound, and about as much more as he can get.

SALT BUTTER IN SMALL PRINTS OR ROLLS.

It would be easier to dispose of salt butter in pound rolls in London than in Manchester, and some think that a profitable market for butter put up in this form could be developed. I am of the opinion, however, that results will not pay for the extra labor and other extra expenses involved in this kind of shipments. Retailers are accustomed to buy salt butter in bulk; much of this is sold direct from lump to customer, though in some of the larger stores purchasers are served with butter already made up in pound parcels, the different butters from which these are made being exposed to view in same shapes as turned out from the original packages. This work of cutting into small pieces and wrapping is done by clerks at intervals when not otherwise employed, and consequently represents little extra cost, and the loss involved in cutting up and weighing for each customer is slight. Some London stores prefer the 56-pound package to any other because this form is so easily made into square pound blocks. In a remarkably short time an expert can divide with a fine wire one of the large pieces into fifty-six small ones and, with a turn or two on his plate and a pat or two, correct the portions into pound prints. If prints are made at the butter factory, the retailer would still be at the necessity of weighing for each separate customer in order to avoid either underweight or overweight, the latter being as grave an error in the eyes of the retailer as the former. If one should contract with a firm having a large retail trade in butter to supply him regularly with a quantity put up in pound packages, so that he could dispense with the services of one or two clerks at his butter counters, then the factory would doubtless get an advance over butter in bulk, but this is the only plan by which I can see how such results could be secured, as the retailer would otherwise be at no saving.

The butter in separate pound lumps, wrapped, in the two shipments which the Department sent, was in better condition on arrival than that sent in bulk. It may be that the superior condition of the butter prepared in this way would more than balance the extra cost of preparation. However, if butter in bulk receives two coverings of first quality of butter parchment, and care is taken in securing well-seasoned woods for boxes, it does not follow that it would not ship well. In fact, as a matter of theory, it ought to ship better. Another point to be considered is that if it becomes the custom to market salt butter put up in pound rolls and each wrapped separately, the opportunities for fraudulent practices, now already quite sufficient, would be greatly increased.

APPENDIX IX.

NOTES ON THE MARKET FOR CHEESE IN ENGLAND.

By NEWTON B. ASHBY,

Special Agent, Bureau of Animal Industry.

The chief consumption of cheese in England is, first, home produced; second, Canadian; third, United States. The production of cheese in the United Kingdom in 1897 was estimated at 147,617 tons English. The imports of cheese into the United Kingdom in 1897 were 130,160 tons. Of the imports 76,351 tons were from Canada and 31,581 tons from the United States, leaving 22,228 tons to represent the imports received from all other countries. It will be seen from the above that the real rivalry for the English markets in imported cheese is between Canada and the United States, with the present odds heavily in Canada's favor. In 1888 the United States sent 40,617 tons of cheese to the English markets, while Canada sent only 33,417 tons. In 1890 the United States sent England 45,920 tons of cheese and Canada sent 41,894 tons. Since 1890 the United States export of cheese to England has been waning and Canada's export waxing at rapid rates. The Canadian cheese now also bears a better reputation in the English markets than the cheese of the United States, both for quality and keeping properties. It is true, however, that in so far as I have been able to observe no distinction or discrimination is made in the retail trade between these cheeses, both being sold as American cheese and at same prices. There are retailers, however, who buy only Canadian cheese for their secondary trade and who will not handle States cheese at all; and also the retailer in general doubtless gives preference in his buying to Canadian, prices on States and Canadians being equal. These give the advantage to Canadians, and wholesalers report that they can pay from 1s. to 2s. per hundred-weight more for Canadian than for States, and especially can they do this at the seasons when cheese is bought for storing.

English Cheddar cheese is the chief cheese consumed in England. This supplies the higher-priced demand. They are sold by the pound, retail, at from 8d. to 10d. Canadian and States cheese is used to supply the secondary demand, or the demand for a Cheddar cheese, and these are retailed by the pound at prices ranging from 5d. to 7d. per pound, usually at about 2d. lower than the pound cut of best English Cheddar. A leading merchant says that with many customers American cheese at 6d. is more in demand than English at 8d.

The English cheese markets for the winter of 1897-98 ruled very low in price, due to a large make at home and to large imports, and also to lessened consumption due to engineers' strike. In October, 1897, the London wholesale price for Canadians was 47s. 6d. per hundredweight, and in March, 1898, 42s. 3d. In May and June of the latter year Canadians were bought, c. i. f., London, as low as 35s. to 37s. 6d.

The best cheese for the English markets is the cheese which comes nearest in make, quality, and appearance to English Cheddar, namely, pale color, mild flavor, close texture, and fine grain, and which will not crack and become dry and brittle upon exposure to air.

In England it is the practice of agents and wholesalers of cheese to buy all cheese, c. i. f. Commission and consignment is scarcely known in the cheese trade. The reason for this is that the grades and qualities of cheese are so well known that dealers can buy with assurance, and consequently the c. i. f. trade can be adopted, and, it being more satisfactory than a commission business, the trade is obliged to adopt it.

Two small shipments of United States fall-made cheese were sent to Manchester early in 1899, and the reports were generally favorable. Most of the cheese was found to be high grade and more salable than the bulk of the commodity reaching that market. The principal criticism was on flavor, which is liable to go off too quickly; it is suggested this may be due to poor curing rooms. The boxes were also criticised as being entirely too light for export trade, many of them having arrived badly broken. The "meat" was perfect. The "texture" was also perfect, except in a few cheeses, where it was too open.—H. E. A.

APPENDIX X.

POTTED SWEET CREAM.

There is a considerable and increasing trade in English cities in sweet cream, which is known as "pure thick cream" and "sweet cream potted," and is sold under various trade names. The supply is from factories scattered throughout England and Ireland, each using milk from its immediate neighborhood. Shipments from long distances have not been successfully inaugurated.

The produce of the counties of Devonshire, Dorsetshire, and Surrey, where pasture lands are especially fine, is regarded as the best, and sometimes sells for as much as 6d. per gallon above poorer creams. As a rule, there is little difference in retail prices; wholesale prices, however, vary with quality. The standard aimed at is a cream which, if churned, would yield 6 pounds of butter to the imperial gallon.

The favorite package is a brown earthenware jug holding one-fourth or one-half pint. Pint and quart jugs are also sold, but are not so common. It is said that tin or glass packages would not meet with approval of small purchasers, though such packages might be used for shipments in bulk to wholesalers and restaurants. Usually the cream is packed at the factory ready for retail sale, but in some cases it is forwarded in bulk and repacked or potted by the wholesaler. By the latter method the cost of freight is materially reduced, as the little jugs weigh more than the cream they carry. The purchaser pays for the package, and a rebate of a halfpenny (1 cent) is usually allowed by the retailer for return of the jug. The wholesaler makes similar allowance to retailer, and he in turn sends them back to the factories.

Preservatives in the cream are almost universally used and regarded as essential. The exact composition of the preservatives is carefully guarded as a secret, but packers freely guarantee that the compounds they use are not prejudicial to health. Probably some form of borax is the principal constituent. One of the supposedly best preservatives is sold for about 62s. per hundredweight (about 13½ cents per pound). The ordinary preservatives cost from 25s. to 35s. per hundredweight less. One-half ounce is the usual amount added for each gallon of cream.

As a rule, the trade is not conducted on a commission basis. The article is purchased by the wholesaler at a fixed price and he delivers, at fair profit, small lots, such as one dozen or one-half dozen jugs, to the retailers. Prices depend largely on demand. In April, 1897, sweet cream potted was advertised in Manchester as follows:

Pure thick cream, by passenger train, freight paid:		s.	d.	
Case containing 12 ½-pint jars	per dozen	4	6	or \$1.09½
Tins containing 1 gallon	per gallon	7	6	or 1.82½
Tins containing 2 or 3 gallons	do	7	0	or 1.70½
Tins containing 5 gallons	do	6	9	or 1.64
Tins containing over 5 gallons	do	6	6	or 1.58

The following is an analysis of the cost of producing sweet cream for market:
Value of milk, 4d. (8 cents) per gallon.

Thin cream:	s.	d.	
Nine gallons milk, at 4d.....	3	0	or \$0.73
Making.....	0	4	or .08
Spillage.....	0	3½	or .07
Cost of 1 gallon thin cream.....	3	7½	or .88
Thick cream:			
14½ gallons milk, at 4d.....	4	9	or 1.15½
Making.....	0	4	or .08
Spillage.....	0	3	or .06
Cost per gallon thick cream.....	5	4	or 1.29½
Say, cost of freight 6d. per gallon.....	0	6	or .12
Cost of delivery.....	5	10	or 1.41½

Thus there appears to be a much better profit on thick cream than can be netted on butter.

APPENDIX XI:

MARKET QUOTATIONS ON BUTTER, 1897 TO 1899.

Week ended—	Danish butter in London.		States butter in London.		Week ended—	Extra creamery in New York, per pound.
	Per hundred weight.	Per pound.	Per hundred weight.	Per pound.		
1897.	Shillings.	Cents.	Shillings.	Cents.	1897.	Cents.
Jan. 1.....	120	26.07	90	19.55	Jan. 5	20
8.....	120	26.07	90	19.55	12	20
15.....	120	26.07	90	19.55	19	20
22.....	116	25.19	90	19.55	26	20
29.....	114	24.76	88	19.12	Feb. 2	20½
Feb. 5.....	114	24.76	90	19.55	9	21½
12.....	112	24.33	90	19.55	16	20
19.....	110	23.90	87	18.90	23	19
26.....	108	23.46	84	18.25	Mar. 2	19
Mar. 5.....	108	23.43	84	18.25	9	19
12.....	108	23.46	80	17.38	16	19
19.....	106	23.03	80	17.38	23	19
26.....	106	23.03	80	17.38	30	21
Apr. 2.....	104	22.60	78	16.95	Apr. 6	20
9.....	102	22.16	70	15.21	13	18
16.....	102	22.16			20	17
23.....	98	21.29			26	17
30.....	98	21.29			May 4	17
May 7.....	96	20.86			11	15
14.....	96	20.86			18	14
21.....	94	20.42			26	15½
28.....	94	20.42			June 1	15
June 4.....	94	20.42			8	15
11.....	94	20.42			15	15
18.....	96	20.86			22	15
25.....	98	21.29			29	15
July 2.....	103	22.78			July 6	15
9.....	98	21.29	84	18.25	13	15
16.....	98	21.29	84	18.25	20	15
23.....	98	21.29	84	18.25	27	15

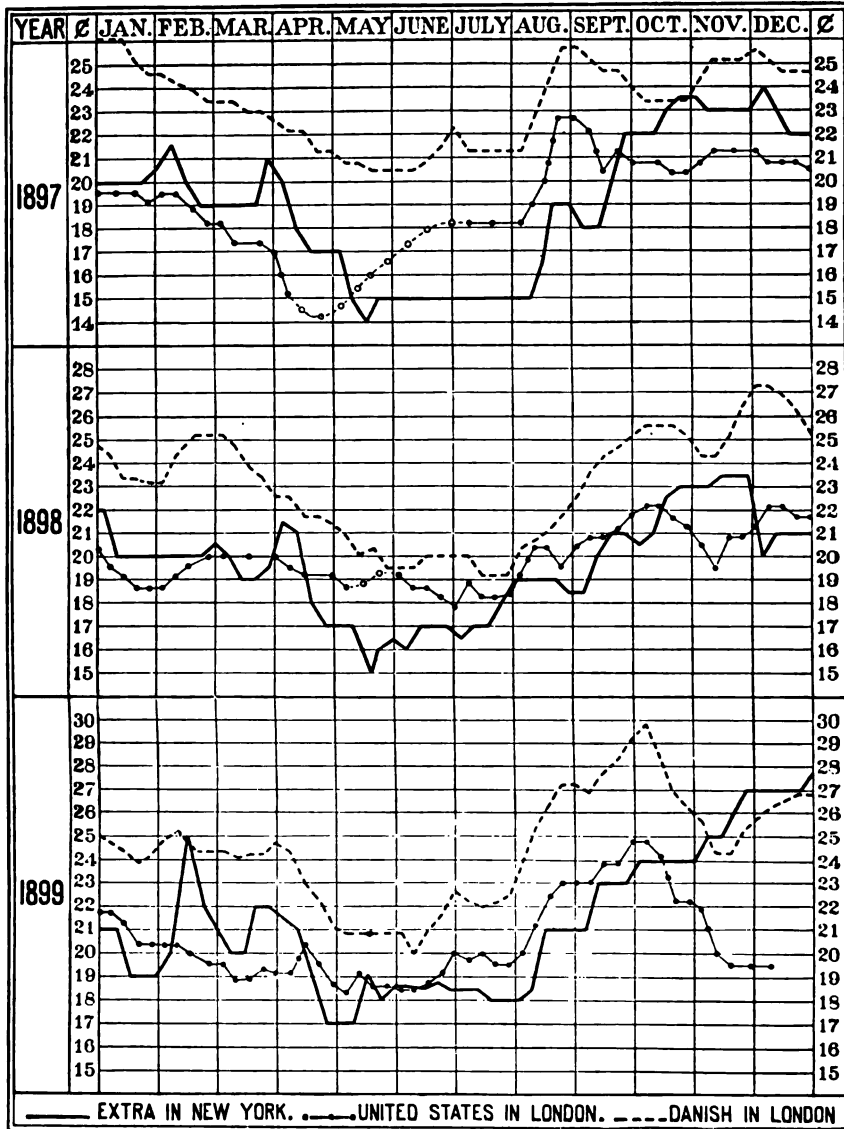


FIG. 1.—Diagram showing butter quotations in New York and London.

Market quotations on butter, 1897 to 1899—Continued.

Week ended—	Danish butter in London.		States butter in London.		Week ended—	Ext creery New York, per pound.
	Per hundred weight.	Per pound.	Per hundred weight.	Per pound.		
1897.	<i>Shillings.</i>	<i>Cents.</i>	<i>Shillings.</i>	<i>Cents.</i>	1897.	<i>Cen.</i>
July 30	98	21.29	84	18.25	Aug. 3	
Aug. 6	98	21.29	84	18.25	10	
13	104	22.60	88	19.12	17	
20	110	23.90	92	19.99	24	
27	118	25.63	104	22.60	21	
Sept. 3	118	25.63	104	22.60	Sept. 7	
10	116	25.19	102	22.16	14	
17	114	24.76	94	22.42	21	
24	114	24.76	98	21.29	28	
Oct. 1	110	23.90	96	20.86	Oct. 5	
8	108	23.46	96	20.86	12	
15	108	23.46	96	20.86	19	
22	108	23.46	94	20.42	26	
29	108	23.46	94	20.42	Nov. 1	
Nov. 5	112	24.33	96	20.86	9	
12	116	25.19	98	21.29	16	
19	116	25.19	98	21.29	23	
26	116	25.19	98	21.29	30	
Dec. 3	118	25.63	98	21.29	Dec. 7	
10	116	25.19	96	20.86	14	
17	114	24.76	96	20.86	21	
24	114	24.76	96	20.86	28	
31	114	24.76	94	20.42		
1898.					1898.	
Jan. 7	112	24.33	90	19.55	Jan. 4	
14	108	23.46	88	19.12	11	
21	108	23.46	86	18.68	18	
28	106	23.03	86	18.68	25	
Feb. 4	106	23.03	86	18.68	Feb. 1	
11	112	24.33	88	19.12	8	
18	116	25.19	90	19.55	15	
25	116	25.19	92	19.99	22	
Mar. 4	116	25.19	92	19.99	Mar. 1	
11	114	24.77	92	19.99	8	
18	110	23.90	92	19.99	15	
25	108	23.46	92	19.99	22	
Apr. 1	104	22.60	92	19.99	29	
8	104	22.60	90	19.55	Apr. 5	
15	100	21.73	88	19.12	12	
22	100	21.73	88	19.12	19	
29	98	21.29	88	19.12	26	
May 6	96	20.86	86	18.68	May 3	
13	92	19.99			10	
20	94	20.42			17	
27	90	19.55			24	
June 3	90	19.55	88	19.12	June 1	
10	90	19.55	86	18.68	7	
17	92	19.99	86	18.68	15	
24	92	19.99	84	18.25	21	
July 1	92	19.99	82	17.82	28	
8	92	19.99	87	18.90	July 5	
15	88	19.12	84	18.25	12	

Market quotations on butter, 1897 to 1899—Continued.

Week ended—	Danish butter in London.		States butter in London.		Week ended—	Extra creamery in New York, per pound.
	Per hundred weight.	Per pound.	Per hundred weight.	Per pound.		
1898.	Shillings.	Cents.	Shillings.	Cents.	1898.	Cents.
July 22.....	88	19.12	84	18.25	July 19	17
29.....	88	19.12	85	18.47	26	18
Aug. 5.....	94	20.42	80	19.34	Aug. 2	19
12.....	96	20.86	94	20.42	9	19
19.....	97	21.07	94	20.42	16	19
26.....	100	21.73	90	19.55	23	19
Sept. 2.....	104	22.60	94	20.42	30	18½
9.....	109	23.68	96	20.86	Sept. 6	18½
16.....	112	24.33	96	20.86	13	20
23.....	114	24.76	98	21.20	20	21
30.....	116	25.19	100	21.73	27	21
Oct. 7.....	118	25.63	102	22.16	Oct. 4	20½
14.....	118	25.63	102	22.16	11	21
21.....	118	25.63	100	21.73	18	22½
28.....	116	25.19	98	21.20	25	23
Nov. 4.....	112	24.33	94	20.42	Nov. 1	23
11.....	112	24.33	90	19.55	7	23
18.....	116	25.19	96	20.86	15	23½
25.....	122	26.50	96	20.86	22	23½
Dec. 2.....	126	27.37	98	21.20	29	23½
9.....	126	27.37	102	22.16	Dec. 6	20
16.....	124	26.94	102	22.16	13	21
23.....	120	26.07	100	21.73	20	21
30.....	116	25.19	100	21.73	27	21
1899.					1899.	
Jan. 6.....	114	24.76	100	21.73	Jan. 3	21
13.....	112	24.33	98	21.20	10	21
20.....	110	23.90	94	20.42	17	19
27.....	111	24.11	94	20.42	24	19
Feb. 3.....	114	24.76	94	20.42	31	19
10.....	116	25.19	94	20.42	Feb. 7	20
17.....	112	24.33	92	19.99	14	25
24.....	112	24.33	90	19.55	21	22
Mar. 3.....	112	24.33	90	19.55	28	21
10.....	111	24.11	87	18.90	Mar. 7	20
17.....	112	24.33	87	18.90	14	20
24.....	112	24.33	89	19.34	21	22
31.....	114	24.76	88	19.12	28	22
Apr. 7.....	112	24.33	88	19.12	Apr. 4	21½
14.....	106	23.63	94	20.42	11	21
21.....	102	22.16	90	19.55	18	19
28.....	97	21.07	86	18.68	25	17
May 5.....	96	20.86	84	18.25	May 2	17
12.....	96	20.86	82	19.12	9	17
19.....	96	20.86	86	18.68	16	19
26.....	96	20.86	86	18.68	23	18
Jun. 2.....	96	20.86	85	18.47	30	18½
9.....	92	19.99	85	18.47	June 6	18½
16.....	96	20.86	86	18.68	13	18½
23.....	100	21.73	88	19.12	20	18½
30.....	104	22.60	92	19.99	27	18½
July 7.....	102	22.16	91	19.77	July 3	18½

Market quotations on butter, 1897 to 1899—Continued.

Week ended—	Danish butter in London.		States butter in London.		Week ended—	Extra creamery in New York, per pound.
	Per hundred weight.	Per pound.	Per hundred weight.	Per pound.		
1899.	<i>Shillings.</i>	<i>Cents.</i>	<i>Shillings.</i>	<i>Cents.</i>	1899.	<i>Cents.</i>
July 14.....	101	21.94	92	19.99	July 11	18½
21.....	102	22.16	90	19.55	18	18
28.....	104	22.60	90	19.55	25	18
Aug. 4.....	110	23.90	92	19.99	Aug. 1	18
11.....	117	25.41	97	21.07	8	18½
18.....	121	26.28	103	22.38	15	21
25.....	125	27.16	106	23.03	22	21
Sept. 2.....	125	27.16	106	23.03	29	21
9.....	124	26.94	106	23.03	Sept. 5	21
16.....	128	27.81	110	23.90	12	23
23.....	130	28.24	110	23.90	19	23
30.....	134	29.11	114	24.76	26	23
Oct. 7.....	137	29.76	114	24.76	Oct. 3	24
14.....	131	28.46	111	24.11	10	24
21.....	124	26.94	102	22.16	17	24
28.....	120	26.07	102	22.16	24	24
Nov. 4.....	118	25.63	101	21.94	31	24
11.....	112	24.33	92	19.99	Nov. 6	25
18.....	112	24.33	90	19.55	14	25
25.....	116	25.19	90	19.55	21	26
Dec. 2.....	119	25.85	90	19.55	28	27
9.....	120	26.07	90	19.55	Dec. 5	27
15.....	122	26.50			12	27
22.....	124	26.94			19	27
29.....	124	26.94			26	27

APPENDIX XII.

THE PARIS BUTTER AND CHEESE MARKETS.

By NEWTON B. ASHBY,

Special Agent, Bureau of Animal Industry.

The greater share of the produce consumed in Paris is sold in what is called Halles Centrales de Paris, or Central Market House. This central market covers a great space, and is divided into numerous halls or pavilions for the various classes of produce. For example, one hall is set aside for the sale of butter, cheese, and eggs, another for live and dressed poultry, etc. The sellers in these markets are called *manda taires*, or *facteurs*—that is, agents or factors. The markets are regulated by ordinance, and are under strict police inspection. They are required to be held every day in the week except Sunday; fête days or holidays make no exception. The ordinance provides the hours when the markets must open for sale by private agreement and for public auction. While the auction is proceeding no sale can be made in the market at private treaty. After each market the factors must exhibit to the proper inspectors their books, which show to whom sales were made, the amounts sold, the prices secured, and in fact the complete transactions of the day. There is nothing to prevent produce being sold outside of the markets by those who are not factors, but the business of selling seems to be chiefly carried on in the central markets.

WHOLESALE BUTTER MARKET.

Butter is sold chiefly in the central market and by auction. There are certain hours in each day when the factors are permitted to sell by private treaty, but the general preference is to sell and to buy at public auction, and hence sales by private treaty are few. The charge for selling is 3 per cent on the gross proceeds. The octroi tax is 14 francs 40 centimes per 100 kilos, or \$2.10 for 220.46 pounds, or about 1 cent per pound. The market charges are 1 franc per 100 kilos, and the charges for carrying by the force employed for this service 15 centimes per package. If 220 pounds of butter put up in four packages were sold in the central market for, say, 300 francs, the costs would be as follows:¹

	Francs.
Commission at 3 per cent on 300 francs	9.00
Octroi at 14.40 francs per 100 kilos	14.40
Market charges	1.00
Carrying charges at 15 centimes per package .....	.60
Total charges in market	25.00

Ordinances governing sales are as follows: (1) The market for the sale in gross of butter, cheese, and eggs shall be held every day, Sundays excepted; (2) The opening of the sales by private treaty shall begin at 6 o'clock in the morning from March 1 to October 31, and at 7 from November 1 to the last day of February. The auction of butter in bulk shall begin at 8.30 o'clock a. m. from March 1 to October 31, and at 9 o'clock from November 1 to the last day of February. The sales of butter in half kilograms begins, respectively, at 7 a. m. and at 8 a. m., in accord with the season of year.

The market shall be closed by the sounding of the bell; when the bell sounds for closing, further sales are forbidden. Any merchandise not sold must remain in the market under the care of the employees of the markets, who are the agents of the police. At the sound of the bell closing the sales everyone must quit the market immediately except the employees of the markets and the factors and those in their employ. No one must go into the halls of the markets at other times than the hours of sale except consignors, the factors, and their employees, and these all must have permits.

It is forbidden that margarine (oleomargarine) be brought into the butter pavilion on any pretext whatever. If butters are suspected of being adulterated, they are taken in charge and sent to the laboratory of the municipal chemist for analysis. I may add here that retailers of butter are forbidden to sell margarines or any butter substitutes, and it is a finable offense to have any of these upon the premises upon any pretext. The fine is from 100 to 5,000 francs, or imprisonment from six days to three months, or both fine and imprisonment. The driver of a wagon delivering butter may be fined from 50 to 500 francs for having margarine or butter substitutes in his wagon.

Factors or their agents or merchants or their agents are forbidden to take notes of prices being obtained at the various stalls in the markets.

It is established that butters sold upon the market must be sold in the original package, and the unit upon which price shall be based is the kilogram. Packages of butter must be numbered and officially weighed in the order of their arrival upon the market, and the weight marked upon the package before it can be offered for sale.

Dirty and rancid butters form a class to themselves, and can be sold only after the close of sales for the other classes.

How butter is sent to market.—There is some sale in the general market of butter

¹ 1 franc=100 centimes=19½ cents. 1 kilogram (or kilo)=2½ pounds.

put up in packages containing one-half kilogram, that is, about 1 pound, but this kind is limited in quantity, and sold chiefly for confectionery purposes. Most of the butter (and from all districts) comes in *en motte* (that is, in bulk) in willow baskets, holding from 8 to 12 kilos (18 to 26 pounds). The baskets vary in shape in accord with the district from which sent. The butter is wrapped simply in a calico or linen cloth. The ordinances provide that all butters sent to market must be wrapped in clean or new cloths and without seams. (This latter, I presume, is to prevent cloths being used that have been in other service.) It is also a matter of regulation that the cloth must be ample to protect the butter, but if too ample then a deduction of 500 grams on the package is made. White calico of close texture is preferred by merchants and factors, but the butters from the district of Isigny, which are the highest priced butters reaching the Paris market, are wrapped in unbleached linen of a dirty shade. This presents an unsightly appearance, but it is a very old custom and is now used as a sort of trade-mark. The baskets are rectangular in shape with bulging sides and rounded corners.

The butters are sent to market and sold with as much dispatch after making as circumstances will allow, and it is probable that the greater share are consumed before a week old.

Method of sale.—As I have said, very little, if any, butter is sold on the market at private treaty. It is chiefly sold at public auction, or, as called in the ordinance, *à la crier*. The crier stands at the head of two long tables, each about 14 to 18 inches wide and placed about 6 feet apart; at his elbow is his clerk. The buyers swarm on each side of these tables, and each provided with a small sampler. It is provided that this sampler shall not exceed 12 millimeters in diameter. The attendants put the original package upon the foot of the table and it is passed on to the head. Each buyer as it passes thrusts his sampler through the cloth wrapper and withdraws his particle for testing. If more than 100 grams are lost in sampling, then the package must stand a dock of 500 grams in weight. All this time the crier is calling *deux franc trois*, etc., until knocked down to the highest bidder. It is the custom to clear the market every day and leave none unsold.

Amount of butter sold on market.—On the 20th of July, when I visited the market, the amount of butter to be sold was reckoned at 60,000 kilograms, or 132,276 pounds. This was a midweek sale and, with exception of Saturday, is the day of heaviest receipts and sales. The sales of the market in 1897 aggregated 12,483,236 kilograms, or 27,527,166 pounds, an average per day of about 88,000 pounds.

Prices.—On July 20, Isigny sold from 180 to 534 francs per 100 kilograms, Paiton 160 to 368, Normandie 160 to 246, Bretagne 190 to 230, Nord et Est 180 to 224, Touraine 170 to 240, Miscellaney 140 to 296, Gâtirais 170 to 184. Of Isigny, not above 200 kilograms, I was told, brought the 5 francs 34 centimes per kilogram, or 50 cents a pound. Two-thirds of the 60,000 kilograms were estimated to have sold from 180 to 210 per kilogram. The Isigny butter is said to be made from creams raised by old methods of setting, and is dairy made. Gâtirais are what we would term store butters, in that the country storekeepers receive them from farmers and consign them to market. The others enumerated—that is, Paiton, Normandie, Bretagne, Nord et Est, and Touraine—are called *laiters*; that is, made by creamery process, in the scarce season, prices average 2 to 3 francs per kilogram better than the prices quoted. Best Isigny would bring probably 80 to 85 cents a pound and lower grades advance more in proportion.

RETAIL BUTTER MARKET.

In most of the retail shops, butters are exposed for sale in the lump, and customers are served by cutting from this lump; but in the mammoth business carried on by one man the methods are so different that I shall give an account of them. This man carries on business as a provisioner in two immense stores, one on Bou-

levard Malesherbes and the other on Boulevard Sébastopol. There is scarcely nothing in lines of food products and preparations which is not carried by him in his gigantic stocks. His stores are equipped with chill rooms, etc., and are models of neatness and convenience. In his great business he buys very largely direct. The butters sold in his stores are prepared especially for his trade. The Isigny and better classes of butter are put up in rolls weighing one-fourth and one-half kilogram, each wrapped in white paper. They are exposed in this form for sale, but they are sent to him in wooden boxes or willow baskets holding about 25 kilograms. Some of the cheaper butters come in lumps of about one-half kilogram and wrapped in leaves of the vine. I found Isigny selling at retail here at 1 franc per one-fourth kilogram. Here, as at the market, I found the best butter very sweet, having the taste of sweet cream, and not of much more consistency than condensed cream. Here I found salt butter from Brittany on sale. I judge it to contain about 3 per cent salt. It was in lumps, and also in little circular willow baskets containing one-half kilogram. The price was 1 franc per one-half kilogram. I was told that its use was decreasing, even for cooking purposes.

Any and every kind of preservative in butter except salt is forbidden by law. No borax or borax compounds may be used. Coloring matter may be employed. French butters are not colored, however.

There is no market in Paris for salt butters for table use and only a very limited market for salt butters for cooking and confectioners' purposes. Thus far efforts to introduce States butter have not been successful and I am of opinion that consignments of our butter to Paris would in the first instances, at least, result in considerable loss.

CHEESE MARKETS.

The cheese consumed in Paris is chiefly the soft cheese of the country, called fromages frais, or pie, or De Brie, Lirarat, etc., from the place where made. The fromages frais is a sort of smearcase, or cottage cheese. All this soft cheese requires speedy consumption, and is sold by auction à la crier in Halles Centrales. The ordinance provides the quantities which shall be offered at a time and the unit upon which price shall be based. They are packed in small boxes holding about one-fourth kilogram, and there are about 60 of these in a case. Some are sold by a dozen as a unit of price, some with 100 as the unit, some by unit of 10 kilograms. Dutch cheese, such as Gouda, and Swiss cheese, such as Gruyère, is called sec, or dry. It is sold by private treaty. The unit of sale is the piece when weight does not exceed 10 kilograms and by kilograms when the cheese is more than 10 kilograms in weight. Lirarat is sold by the hundred, each cheese containing about one-fourth kilogram, and were selling in Halles Centrales at 25 to 30 francs. Gruyère was worth 1.50 to 1.75 francs per kilogram. At retail I saw Gruyère on sale at 1 to 1.30 francs; Gouda at 1 to 1.20 francs; Cambert (soft cheese), in boxes of one-fourth kilogram, 90 centimes a box.

The octroi tax on cheese is 9.50 francs per 100 kilograms.

I would not recommend sending States cheese to Paris markets.

APPENDIX XIII.

THE HAMBURG BUTTER AND CHEESE MARKET.

From report of NEWTON B. ASHBY,

Special Agent, Bureau of Animal Industry.

A prominent firm recommends that any shipments be sent by small vessels. Large vessels should not be employed if avoidable, as with their great draft they are unable to come to wharf in case of east winds and the resulting low water, and hence must first be partly unloaded by lighters.

German tariffs are specific and are on gross weights:¹

	Marks.
On butter, 100 kilograms ²	16
On cheese, 100 kilograms	15 to 20

The rate on Swiss cheese is lower than Holland. States would probably come in at lowest rate.

	Marks.
On poultry per 100 kilograms	30
On eggs per 100 kilograms	2

Cold stores are rented by the season and no short-time rates are made. The rate on butter is 2.7 marks per 50 kilograms (110 pounds) or for space taken by kiel keg. Butter may be taken out and the space thus vacated refilled as often as the renter wishes.

BUTTER.

The outlook for trade in butter at this point is not promising. A prominent merchant thinks that nothing can be done in our best butters, but that a considerable trade may be done in tub butters and second and third grades.

The following are the obstacles to be encountered in exporting butter for sale in Hamburg or Germany:

1. There is a specific duty on butter of 8 marks per 50 kilograms, or, in round figures, \$2 on 110 pounds.³

2. Germany exports butter, prices usually being lower than in England, and very largely supplies the home demand for best creamery butters. The best Holstein butters are worth at present, in the Hamburg wholesale markets, 90 to 92 marks per Kiel cask of 112 pounds. This butter is very generally retailed at 1 to 1.1 marks per pound. In the scarcer season the best butter retails at 1.2 to 1.4 marks, but 1.3 marks is regarded as about the maximum. The second grade of butter is commonly sold at about 20 pfennigs (0.2 mark) below first grade.

3. The influence of the Agrarian party is sufficient to create more or less prejudice against any foreign article which comes into competition with German produce until such article becomes established and known to the public.

Considerable States butter in tubs now reaches this port, but it is probable that very little of it enters and pays duty. I believe it is bought c. i. f.

A well-known firm told me they bought 20 tubs out of a lot of 120, paying at rate of 70 marks per 100 pounds c. i. f. This butter was bought for ship stores and did not enter and pay duty. I understand that a considerable trade is now carried on in State butters in this way, at about 68 to 70 marks. A well-informed merchant is of opinion that it is in grades of butter which would sell at from 60 to 75 marks c. i. f. that we could hope to develop most satisfactory trade. I would advise, in shipments here, that at least one-half of shipments should be the tub butters, but also that a part be of the best creamery butter in boxes. In retail trade it is not the custom to expose the butter for sale. It is kept in the keg or box in which put up, and the customer is served without seeing the butter except the portion bought.

States butter sent by the Department arrived by the *Phœnicia* Monday, August 15. The boxes were discharged from refrigerator from 1.30 to 2.30 p. m. and the tubs about 3.50 p. m. All were in apparently good condition, but tub No. 6 handled so lightly that it was apparent it was not full, in accord with schedule. The temperature was high, 86° to 90° F. in shade, and this temperature, running up to about 90°, continued until close of the 17th. The butter stood in the shed of the company at Oswaldi Quay on south side of Elbe until 9.30 a. m., 16th

¹ 1 mark = 100 pfennig = about 24 cents. The Hamburg pound is equivalent to 1.0679 pounds avoirdupois.

² 220.46 pounds, United States.

³ The German hundredweight is 50 kilograms, or 110 pounds.

when Herr Hermann Kaiser and myself met buyers at the shed and made an examination of the butters. No. 6 on examination showed that the lower third of the butter had been cut away by some rough instrument, probably a coarse wire, and the butter which had been removed from the tub for the purpose had then been replaced. The schedule weight on card was 66 pounds avoirdupois, gross. This was equal to 59.99 German pounds. The tub in Hamburg weighed, gross, 43 pounds and net 32 pounds, showing a loss of nearly 19 pounds, avoirdupois. I was present when butter was taken out of refrigerator and know the loss occurred previous to removal from the refrigerator.

It had been our expectation to dispose of these butters in the free port for ship cabin butters, and thus secure a better price without payment of duties. The "F" lot in first shipment was so well received that brokers were of opinion that this second lot would sell for cabin butters practically at prices for best German, and Herr Kaiser expected to be able to return 88 to 92 marks per hundred weight without deductions for duties. The butter merchants, however, on examination found that the butters were not satisfactory to sell for cabin butters and hence sale in free port failed and Herr Kaiser entered the butters and had them removed to his cellar. The opinion of some merchants was that a portion was old before it was shipped, but it did not appear to me that it had an old taste. The butter had an unclean flavor of some sort and left a lardy taste in the mouth. Another portion, in tubs, was not so well made, being coarser in grain, more watery, and had too much salt by far, but it had a new, sweet, and clean taste, and on the morning of 17th it sold at 85 marks, while 82 marks was all that could be obtained for the remainder. The butter which went for the higher price will be sold as table butter. The sale of the "F" butters in the branch stores of one merchant turned out very satisfactorily and he could have a large sale of these butters at prices about 10 pfennigs below first quality. The wholesale price of best butter is now 95 to 97 marks, but retail prices remain at 1 mark to 1.10 marks per pound for best grades.

Our creamery butter in Hamburg takes rank next to best German Creamery. It is regarded by the trade quite equal to best German makes except in the one element of freshness. It has the advantage over German butter of having more body and substance. The Holstein and north Schleswig creamery butters, however, come upon the Hamburg market in fine, sweet condition, and with a freshness and aroma of flavor which our butters have lost in ocean transit. This fact alone will prevent our butter from taking the first rank, unless some means can be discovered of retaining in the butter for some weeks its first fresh flavor.

I am of opinion that further efforts should be made in Hamburg, and for this purpose more shipments of specially prepared creamery in boxes be sent for sale in the free port. There will be no advantage in packing in pound lumps, and the butter should be the best that can be obtained. I think it probable that a market can be found in free port at prices practically as good as for best German, and here we might build up a limited trade in butter for cabin use on the Atlantic steamship lines. As there are no duties to be paid in the free port, there will be a substantial advantage in this respect over Hamburg.

So far as the trade is concerned, I do not think we have any discriminations to fear, but retailers would doubtless find some difficulty in selling our butter if it were known to consumers that it was imported.

The usual commission charged is 3 per cent on gross sales and 1 per cent brokerage, making a total of 4 per cent. In addition, there is a charge of one-half mark per 50 kilos to cover quay dues, drayage, etc. Warehouse charges are so high that it is the custom for merchants to bring produce direct to their own stores.

Color.—The color wanted at present is a rich cream, but not a deep yellow, and during the season when cows are on dry feed much paler is in demand.

Salt.—About 3 per cent of salt is the usual proportion.

Package.—The usual package is the Kiel cask, but tubs and boxes are not objectionable. Butter in prints or pound rolls is not known to the Hamburg trade, but it is thought such a trade might be successfully developed.

CHEESE.

American cheese is not sold in German markets. Filled cheese of the United States was thrown on German markets with bad results. There is an opinion here that best American cheese could possibly be introduced with good results. The cheese now occupying the market is chiefly Swiss, Holland, and German. Germany however gives little attention to making cheese. The retail price of best cheese is from 1 mark to 1 mark 20 pfennigs per pound. Commission charges are 2½ per cent on gross sales.

APPENDIX XIV.

SCORES OF BUTTER EXPORTED.

Shipment No.	Creamery mark.	American scores (in New York).							Foreign scores.						
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
10	N	July 14	41	25	15	10	5	96	July 22	40	24	13	10	4	91
										35	19	9.5	9.5	4	80
12	N	July 14	40	24	15	10	5	94	Aug. 5	39.5	23	13.5	8.5	4	88.5
		July 23	40	24	15	10	5	94		39	23	13.5	8	4	87.5
		Aug. 5	40	24	15	10	5	94							
		Aug. 18	39	24	15	10	5	93							
11	N	July 23	38	24	15	10	5	92	Aug. 9	40	24.5	14	9	4	91.5
		Aug. 5	38	24	15	10	5	92		39.5	24.5	13.5	9	4	90.5
		Aug. 18	37	24	15	10	5	91							
16	N	Aug. 5	39	24	9	10	5	87	Aug. 16	40.5	25	13.5	10	4	93
		Aug. 18	39	24	9	10	5	87		38.5	24	13.5	9.5	4	89.5
18	N	Aug. 5	37	24	15	10	5	91	Aug. 19	41	25	14	9.5	5	94.5
		Aug. 18	37	24	15	10	5	91		39.5	25	14.5	9.5	5	93.5
		Aug. 31	36	24	15	10	5	90							
		Sept. 17	35	24	15	10	5	89							
		Sept. 29	34	24	15	10	5	88							
		Oct. 15	33	24	15	10	5	87							
		Oct. 29	31	24	15	10	5	85							
20	N	Aug. 18	40	24	15	10	5	94	Aug. 30	39.5	25	14	9	5	92.5
		Aug. 31	40	24	15	10	5	94		38	25	13.5	10	5	91.5
		Sept. 17	40	24	15	10	5	94							
		Sept. 29	39	24	15	10	5	93							
		Oct. 15	38	24	15	10	5	92							
		Oct. 29	37	24	15	10	5	91							
22	N	Aug. 18	39	24	15	10	5	93	Sept. 8	40.5	25	15	10	5	95.5
		Aug. 31	39	24	15	10	5	93		39	23	13.5	10	5	90.5
		Sept. 17	38	24	15	10	5	92							
		Sept. 29	37	24	15	10	5	91							
		Oct. 15	37	24	15	10	5	91							
		Oct. 29	36	24	15	10	5	90							
24	N	Aug. 31	38	24	15	9	5	91	Sept. 8	39	25	13.5	10	5	92.5
		Sept. 17	38	24	15	9	5	91		38	25	13.5	10	5	91.5
		Sept. 29	38	24	15	9	5	91							
		Oct. 15	37	24	15	9	5	90							
		Oct. 29	37	24	15	9	5	90							

a Mottled.

Scores of butter exported—Continued.

Shipment No.	Creamery mark.	American (in New York).							Foreign.						
		Date scored.	Flavor, 45.	Body, 45.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
26	N	Aug. 31	38	24	15	9	5	91	Sept. 19	39.5	25	14	10	5	93.5
		Sept. 17	38	24	15	9	5	91		37.5	25	14	9	5	90.5
		Sept. 29	38	24	15	9	5	91							
		Oct. 15	37	24	15	9	5	90							
		Oct. 29	37	24	15	9	5	90							
28	N	Sept. 17	40	24	15	10	5	94	Sept. 26	39.5	24	14	9	5	91.5
		Sept. 29	40	24	15	10	5	94		38	23.5	13.5	10	5	90
		Oct. 15	39	24	15	10	5	93							
		Oct. 29	38	24	15	10	5	92							
		Dec. 6	33	24	15	10	5	87							
		Jan. 7	33	24	15	10	5	87							
30	N	Sept. 17	39	24	15	10	5	93	Oct. 4	39.5	25	14	10	5	93.5
		Sept. 29	38	24	15	10	5	92		38.5	25	13.5	9.5	5	91.5
		Oct. 15	38	24	15	10	5	92							
		Oct. 29	38	24	15	10	5	92							
32	N	Sept. 29	41	24	15	9	5	94	Oct. 10	41	25	13.5	9	5	93.5
		Oct. 15	41	24	15	9	5	93		37.5	25	13.5	9	5	90
		Oct. 29	40	24	15	9	5	93							
34	N							Oct. 15	41	25	14	9	5	94	
									40	25	13.5	9	5	92.5	
36	N							Oct. 22	41	25	11.5	10	5	95.5	
									39.5	25	14.5	10	5	94	
38	N							Oct. 29	39.5	25	14.5	10	5	94	
									39	24.5	14	9	5	91.5	
40	N							Nov. 5	39	25	14.5	10	5	93.5	
									37	25	14	9.5	5	90.5	
42	N							Nov. 14	40.5	25	15	9.5	5	95	
									38	24.5	14.5	9	5	91	
43	N							Nov. 23	39	25	14	9.5	5	92.5	
									36	25	14	9.5	5	90.5	
44	N							Nov. 29	39.5	25	14.5	9.5	5	93.5	
									38	25	14.5	9.5	5	92	
45	N							Dec. 10	40.5	25	14.5	10	5	95	
									38	25	14.5	10	5	92.5	
46	N							Dec. 17	42	25	14	10	5	96	
									39	25	14	10	5	93	
47	N							Dec. 22	41.5	25	15	9.5	5	96	
									39	25	15	9	5	93	
48	N							Dec. 31	41.5	25	15	10	5	94.5	
									39	25	14.5	10	5	93.5	
49	N	Jan. 23	27.5	25	12.5	10	5	a 80	Jan. 5	40.5	25	15	10	5	95.5
										39	25	15	9.5	5	93.5
50	N	Dec. 29	36	24	13	9	5	87	Jan. 10	40.5	25	15	10	5	95.5
		Jan. 23	27.5	25	13	10	5	a 80		39	25	15	10	5	94
52	N								Jan. 19	40.5	25	15	10	5	95.5
										40	25	15	9.5	5	94.5
53	N	Jan. 12	35	24	13	8	5	b 85	Jan. 24	41	25	15	10	5	96
										40	25	15	10	5	95

a These scores were at Sioux Falls, S. Dak., on packages which went to England with regular shipments and were then returned.

b Flavor bitter, body short grain, color very light, salt very light.

Scores of butter exported—Continued.

Shipment No.	Creamery mark.	American (in New York).							Foreign.					
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.
54	N	.....	.....	.....	.....	.....	.....	.....	Jan. 24	41	25	15	10	5
										39.5	25	15	10	5
55	N	.....	.....	.....	.....	.....	.....	.....	Feb. 7	39	25	15	9	5
										37.5	25	15	9	5
56	N	.....	.....	.....	.....	.....	.....	.....	Feb. 16	38	25	14.5	9.5	5
										36	25	14.5	8.5	5
57	N	.....	.....	.....	.....	.....	.....	.....	Feb. 21	37	25	15	10	5
										35	25	15	10	5
58	N	.....	.....	.....	.....	.....	.....	.....	Mar. 9	40.5	25	15	10	5
										38	25	15	10	5
59	N	.....	.....	.....	.....	.....	.....	.....	Mar. 10	38	25	15	10	5
										37	25	15	10	5
60	N	.....	.....	.....	.....	.....	.....	.....	Mar. 16	38.5	25	15	10	5
										37	25	15	10	5
61	N	.....	.....	.....	.....	.....	.....	.....	Mar. 22	38	25	15	10	5
										37	25	15	10	5
62	N	.....	.....	.....	.....	.....	.....	.....	Mar. 29	37	24	15	10	5
										36.5	24	15	10	5
63	N	.....	.....	.....	.....	.....	.....	.....	Apr. 6	38.5	25	15	10	5
										37	25	15	10	5
64	N	.....	.....	.....	.....	.....	.....	.....	Apr. 12	38	25	15	10	5
										36	25	15	10	5
65	N	.....	.....	.....	.....	.....	.....	.....	Apr. 18	40.5	25	15	10	5
										39.5	25	15	10	5
66	N	.....	.....	.....	.....	.....	.....	.....	Apr. 27	37	25	15	10	5
										35	25	15	10	5
67	N	.....	.....	.....	.....	.....	.....	.....	May 3	36	25	15	10	5
										34.5	25	15	10	5
68	N	Apr. 25	33	24	12	8	5	a 82	May 10	37.5	25	15	10	5
										36.5	25	15	10	5
13	L	July 23	39	24	15	10	5	b 93	Aug. 12	45	25	14.5	9.2	5
		Aug. 5	38	24	15	10	5	92						
		Aug. 18	37	24	15	10	5	91						
15	L	Aug. 5	38	24	15	10	5	92	Aug. 22	45	25	14.5	9.5	4.5
		Aug. 18	38	24	15	10	5	92						
17	L	Aug. 5	38	24	15	10	5	92						
		Aug. 18	38	24	15	10	5	92						
		Aug. 31	38	24	15	10	5	92						
19	L	Aug. 18	39	25	15	9	5	93						
		Aug. 31	39	25	15	9	5	93						
		Sept. 17	38	25	15	9	5	92						
		Sept. 29	37	25	15	9	5	91						
		Oct. 15	37	25	15	9	5	91						
		Oct. 29	37	24	15	9	5	90						
21	L	Aug. 18	38	24	15	9	5	91						
		Aug. 31	37	24	15	9	5	90						
		Sept. 17	37	24	15	9	5	90						
		Sept. 29	37	24	15	9	5	90						
		Oct. 15	37	24	15	9	5	90						
		Oct. 29	37	24	15	9	5	90						

a Flavor bitter, body salty, color very light, salt too light.

b Lacks flavor, body light. But considered in London as especially fine butter, only criticized being for too little salt and color.

Scores of butter exported—Continued.

Shipment No.	Creamery mark.	American (in New York).							Foreign.						
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
23	L	Sept. 17	40	25	15	10	5	95							
		Sept. 29	39	25	15	10	5	94							
		Oct. 15	39	25	15	10	5	94							
		Oct. 29	38	25	15	10	5	93							
25	L	Aug. 31	40	25	15	10	5	95							
		Sept. 17	37	25	15	10	5	92							
		Sept. 29	36	25	15	10	5	91							
		Oct. 15	35	25	15	10	5	90							
27	L	Oct. 29	34	25	15	10	5	89							
		Sept. 17	40	25	15	10	5	95							
		Sept. 29	40	25	15	10	5	95							
		Oct. 15	39	25	15	15	5	94							
29	L	Oct. 29	38	25	15	9	5	92							
		Sept. 17	40	24	15	10	5	94							
		Sept. 29	40	24	15	10	5	94							
		Oct. 15	39	24	15	10	5	93							
31	L	Oct. 29	39	24	15	10	5	93							
		Sept. 29	41	24	15	10	5	95							
		Oct. 15	41	24	15	10	5	95							
		Oct. 29	40	24	15	10	5	94							
41	L	Dec. 6	37	24	15	10	5	91							
		Jan. 7	34	24	15	10	5	88							
43	L	Oct. 27	38	24	15	8	5	90							
									Nov. 23	40	25	14.5	10	5	94.5
44	L									37.5	25	14.5	10	5	92
									Nov. 29	41	25	15	10	5	94
45	L									40.5	25	15	10	5	95.5
									Dec. 10	41.5	25	15	10	5	96.5
47	L									40	25	15	10	5	95
									Dec. 22	41	25	15	10	5	96
48	L									39.5	25	14.5	10	5	94
									Dec. 31	40	25	15	10	5	95
49	L									39	25	15	9.5	5	93.5
		Jan. 24	33	25	12.5	10	5	a 85.5	Jan. 5	41	25	15	10	5	96
50	L									40	24	15	10	5	94
		Dec. 29	37	24	13	8	5	b 87	Jan. 10	42	25	15	10	5	97
52	L	Jan. 23	32	25	12.5	10	5	a 84.5		41	25	15	10	5	96
									Jan. 19	40.5	25	15	10	5	95.5
53	L									40	25	15	9.5	5	94.5
		Jan. 12	36	24	13	9	5	b 87	Jan. 24	42	25	15	10	5	97
54	L									40.5	25	15	10	5	95.5
									Feb. 2	42	25	15	10	5	97
55	L									40.5	25	15	10	5	95.5
									Feb. 7	42	25	15	10	5	97
56	L									40	25	15	10	5	95
									Feb. 16	40.5	25	15	10	5	95.5
									39	25	15	10	5	94	

^a These scores were at Sioux Falls, S. Dak., on packages which went to England with regular shipments and were then returned.

^b Lacks flavor, very flat, body little salvy, color very light, salt very light. But Manchester criticism was: Flavor excellent, grain good, color right, salting slightly mild.

BUREAU OF ANIMAL INDUSTRY.

Scores of butter exported—Continued.

Shipment No.	Creamery mark.	American (in New York).						Foreign.							
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
57	L								Feb. 21	39.5	25	15	10	5	94.5
										39.5	25	15	10	5	93.5
58	L								Mar. 9	41	25	15	10	5	96
										39	25	15	10	5	94
59	L								Mar. 10	41.5	25	15	10	5	96.5
										40	25	15	10	5	95
60	L								Mar. 16	41.5	25	15	10	5	96.5
										39	25	15	10	5	94
61	L								Mar. 22	41	25	15	10	5	96
										40	25	15	10	5	95
62	L								Mar. 23	41	25	15	10	5	96
										40	25	15	10	5	95
63	L								Apr. 6	40	25	15	10	5	95
										38	25	15	10	5	93
64	L								Apr. 12	40	25	15	10	5	95
										39	25	15	10	5	94
65	L								Apr. 18	37	25	15	10	5	92
										35	25	15	10	5	90
66	L								Apr. 27	40	25	15	10	5	95
										39	25	15	10	5	94
67	L								May 3	40	25	15	10	5	95
										39	25	15	10	5	94
68	L	Apr. 25	34	24	12	8	5	a 83	May 10	39	25	15	10	5	94
										39	25	15	10	5	94
7	F	July 7	40	25	14	10	5	94	July 11	45	25	15	10	5	100
		July 14	39	25	14	10	5	93							
9	F	July 14	42	25	15	10	5	97	Aug. 11	35	25	b 10	10	5	85
11	F	July 21	39	25	15	10	5	94	Aug. 5	45	25	15	10	5	100
		Aug. 5	38	25	15	10	5	93		40	25	15	10	5	c 95
		Aug. 18	37	25	15	10	5	92							
13	F	July 23	39	25	15	10	5	94	Aug. 12	44	25	14.5	10	5	98.5
		Aug. 5	39	25	15	10	5	92							
		Aug. 18	38	25	15	10	5	93							
15	F	Aug. 5	37	25	15	10	5	d 92	Aug. 22	45	25	14.5	10	5	99.5
		Aug. 18	37	25	15	10	5	92							
17	F	Aug. 5	37	24	15	10	5	91							
		Aug. 18	36	24	15	10	5	90							
		Aug. 31	35	24	15	10	5	89							
19	F	Aug. 18	37	25	15	10	5	92							
		Aug. 31	36	25	15	10	5	91							
		Sept. 17	35	25	15	10	5	90							
		Sept. 20	34	25	15	10	5	89							
		Oct. 15	33	25	15	10	5	88							
		Oct. 20	32	25	15	10	5	87							

a Flavor irregular, some packages bitter, body salty, color too light, salt too light. Manchester criticism was: Flavor fodder, grain excellent, color rather pale, salting right.

b Mottled.

c Rolls.

d Shows no flavor.

Scores of butter exported—Continued.

Shipment No.	Creamery mark.	American (in New York).						Foreign.							
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
21	F	Aug. 18	38	25	15	10	5	93							
		Aug. 31	38	25	15	10	5	93							
		Sept. 17	38	25	15	10	5	93							
		Sept. 29	37	25	15	10	5	92							
		Oct. 15	37	25	15	10	5	92							
		Oct. 29	37	25	15	10	5	92							
23	F	Aug. 31	41	25	15	10	5	96							
		Sept. 17	39	25	15	10	5	94							
		Sept. 29	38	25	15	10	5	93							
		Oct. 15	38	25	15	10	5	93							
		Oct. 29	37	25	15	10	5	92							
25	F	Aug. 31	41	25	15	10	5	96							
		Sept. 17	40	25	15	10	5	95							
		Sept. 29	39	25	15	10	5	94							
		Oct. 15	39	25	15	10	5	94							
		Oct. 29	38	25	15	10	5	93							
27	F	Sept. 17	39	25	15	10	5	94							
		Sept. 29	39	25	15	10	5	94							
		Oct. 15	39	25	15	10	5	94							
		Oct. 29	37	25	15	10	5	92							
29	F	Sept. 17	39	25	15	10	5	94							
		Sept. 29	39	25	15	10	5	94							
		Oct. 15	38	25	15	10	5	93							
		Oct. 29	36	25	15	10	5	91							
41	F	Oct. 27	39	25	15	10	5	94							
13	S	Apr. 27	41	25	15	10	5	96							
		May 25	41	25	15	10	5	96							
		July 7	40	25	15	10	5	95							
		July 14	39	25	15	10	5	94							
7	S	June 21	40	25	15	10	5	a 95	July 11	40	25	15	5	0	85
		July 7	34	24	14	10	5	87		38	25	15	5	0	83
		July 14	33	24	14	10	5	86							
9	S	July 13	40	25	15	10	5	b 95	Aug. 11	25	25	6	6	0	62
		July 23	38	24	11	9	5	87							
		Aug. 5	38	25	15	10	5	93							
		Aug. 18	37	25	15	10	5	92							
11	S	July 28	41	25	15	10	5	96	Aug. 18	27	25	15	5	0	c 72
		May 19	40	25	15	10	5	d 95	May 27	32	24.5	12.5	9	3	81
		July 7	37	25	15	10	5	92		28.5	24	13	10	3	78.5
		July 14	36	25	15	10	5	91							

a June 21, graded creamery extras; July 7, sour and milky; July 14, ditto, London criticism: Flavor shows slight rancidity, too much salt, tubs objectionable.

b July 13, graded as creamery extras; July 23, shows loss in flavor, body affected by mottles, salt too high. Hamburg criticism: Decidedly inferior, flavor old, too much moisture and salt, milk not washed out, color mottled and too high.

c Too salt and too much moisture; milk not washed out properly.

d May 19, has slight burnt flavor; July 7 and 14, burnt and bitter. Manchester criticism: Well bodied butter, robust in make, but rather coarse in grain, quite spoiled by peculiar resinous flavor, which could scarcely be attributed to the "piney" odor of boxes; probably fault of cream ripening.

Scores of butter exported—Continued.

Shipment No.	Creamery mark.	American (in New York).							Foreign.						
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
4	B	June 11	39	24	15	10	5	93	June 21	36	23	13	9	3	84
		July 7	38	24	15	10	5	92		33	22.5	12.5	9	3	80
		July 14	38	24	15	10	5	92							
7	B	July 7	38	25	15	10	5	93	July 11	34	25	15	8.5	4	86.5
		July 14	38	25	15	10	5	93		34	25	15	8.5	4	86.5
11	B	July 14	36	24	15	10	5	90	Aug. 5	20	25	15	10	3	73
		July 23	35	24	15	10	5	89							
		Aug. 5	34	24	15	10	5	88							
		Aug. 18	33	24	15	10	5	87							
6	E	July 7	35	24	12	10	5	86	July 7	36.5	23.5	12	10	3	85
		July 14	34	24	12	10	5	85		34.5	22	11.5	9.5	3	80.5
8	E	July 7	38	25	14	10	5	92	July 20	30	25	15	10	5	85
		July 14	33	25	14	10	5	92							
		July 23	36	25	14	10	5	90							
		Aug. 5	35	25	14	10	5	89							
4	C	Aug. 18	33	25	14	10	5	87							
		June 11	34	24	14	10	5	87	a June 28	37	23.5	14	8.5	3	86
		July 7	32	24	14	10	5	85		33.5	23.5	12	7.5	3	79.5
5	D	July 14	31	24	14	10	5	84							
		June 11	36	25	15	10	5	b 91	June 24	40	25	15	7	0	c 87
		July 7	34	25	15	10	5	89	June 28	30	25	14	2	2	74
51	D	July 14	33	25	15	10	5	88							
		Aug. 5	38	24	15	9	5	91	Aug. 18	23	25	15	10	0	73
		Aug. 18	38	24	15	9	5	91		20	25	15	10	0	70
		Aug. 31	37	24	15	9	5	90							

^a On the day these scores were recorded the same judges scored three other samples in the Manchester market, as follows:

	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
Canadian creamery	30.5	22.5	15	10	5	83
Irish creamery	42	24	14	10	4.5	91.5
Irish creamery	43.5	25	15	10	5	98.5

^b Rolls.

^c Flavor bitter. London criticism: Of rolls, flavor slightly sour; rolls not desirable for salt butter; the larger packages scored 28th had their flavor ruined by salt.

NOTES UPON APPENDIX XIV.

During the time of the experimental shipments the butter was scored many times, both in New York and in the foreign markets. (See also scores in Appendix XV.) In a number of cases a sample was held in cold storage in New York and scored at intervals of about two weeks for three months, and sometimes at irregular intervals for longer periods. These successive scorings by the same inspector are decidedly interesting, as they show the deterioration of the butter by long keeping. In two of the principal brands the average loss on flavor in the first two weeks was less than half a point; in the next two weeks it was slightly greater. From the fourth to the sixth week and in each of the few following equal periods the loss on flavor was nearly one point. Aside from flavor

the scores show no change in the butter from long keeping, except in one case when, after eleven weeks, a sample was lowered one point on account of a change in its body, which had been perfect. The scores show the character of the butter which was selected for the experimental shipments. It will be noticed that on style, salt, and color there were few unfavorable criticisms in New York, while there were frequently from four to seven points off on flavor and one on body.

The American scores for any lot were usually on the same box, which was kept for that special purpose, but in two or three cases the first score represents the inspector's judgment after the examination of several packages. On the other side, however, frequently several boxes were examined, and often by two judges who worked independently. In order to simplify matters, their scores on each package are averaged and the highest and lowest averages for each shipment are given. Sometimes they vary considerably, indicating that a number of packages supposed to be exactly alike at first differ considerably after two or three weeks. The differences are not limited to flavor, but include body, color, and salt.

Although the scores reported from foreign sources were, no doubt, most conscientiously made, they can not be safely compared with the New York scores. One reason for this is that like defects were not valued the same by the judges who were accustomed to very different markets. Wide differences in scores may also be due to differences in the individual packages selected, for, as just stated, all the packages of a shipment are not necessarily alike. It seemed to be difficult to fully satisfy the English merchants on such supposedly simple matters as salt and color, but it will be seen that there were improvements in these respects as the season advanced.

APPENDIX XV.

COMPARISON OF PASTEURIZED AND RAW CREAM BUTTER.

[Creamery mark, A.]

Shipment No.	Where scored.	Date scored.	Pasteurized.						Raw.					
			Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
1	New York..	May 11	41	25	15	10	5	96	40	25	15	10	5	95
		May 19	41	25	15	10	5	96	39	25	15	10	5	94
		July 7	38	25	15	10	5	93	37	25	15	10	5	92
		July 14	37	25	15	10	5	92	36	25	15	10	5	91
2	do	May 19	37	25	15	10	5	92	41	24	15	10	5	95
		July 7	39	25	15	10	5	94	41	25	15	10	5	96
		July 14	38	25	15	10	5	93	40	25	15	10	5	95
		May 27	41.5	25	11	10	3	90.5	40	25	11	10	3	89
3	England....		38	23.5	9.5	8	3	82	36	24	12	9.5	3	84.5
		June 11	40	25	15	10	5	95	40	25	15	10	5	95
		July 7	38	25	15	10	5	93	39	25	15	10	5	94
		July 14	38	25	15	10	5	93	38	25	15	10	5	93
4	England....	June 21	40	22	12.5	9	3	86.5	39	22	12.5	10	3	86.5
			39	22	12	7	3	83	38	22.5	12.5	10	3	86
		June 11	41	25	15	10	5	96	35	25	15	10	5	90
		July 7	40	25	15	10	5	95	33	25	15	10	5	88
5	New York..	July 14	39	25	15	10	5	94	32	25	15	10	5	87
		June 27	45	25	13	8	4	95	42	25	13	8	3	91
			45	22	13	8	4	92	43	22	13	8	4	90
		July 7	33	24	15	10	5	87	35	25	15	10	5	90
6	New York..	July 14	32	24	15	10	5	86	34	25	15	10	5	89

Comparison of pasteurized and raw cream butter—Continued.

Shipment No.	Where scored.	Date scored.	Pasteurized.						Raw.					
			Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
6	England ...	July 6	37	24.5	11.5	9.5	3	85.5	35.5	24.5	13	9.5	3	85.5
			36.5	24	12.5	9	3	85	35.5	23.5	10.5	9	3	81.5
8	New York...	July 7	39	24	15	10	5	93	35	25	15	10	5	90
		July 14	39	24	15	10	5	93	34	25	15	10	5	89
10	England ...	July 20	35	25	15	10	5	90	35	25	15	10	5	90
		July 7	41	35	15	10	5	96	40	35	15	10	5	95
		July 14	41	35	15	10	5	96	40	35	15	10	5	95
		July 23	40	38	15	10	5	95	40	35	15	10	5	95
		Aug. 5	40	35	15	10	5	95	40	35	15	10	5	95
		Aug. 18	39	35	15	10	5	94	39	35	15	10	5	94
		July 22	43	24.5	14	10	3	93.5	40.5	24.5	12.5	9.5	3	90
12	New York...	July 14	39	24	15	10	5	93	38	24	15	10	5	92
		July 23	38	24	15	10	5	92	37	24	15	10	5	91
		Aug. 5	37	24	15	10	5	91	36	24	15	10	5	90
		Aug. 18	36	24	15	10	5	90	35	24	15	10	5	89
	England ...	Aug. 5	40.5	23	14	8	3	88.5	40	23	14	9	3	89
			38.5	23	14	9	3	87.5	39	23	13	9	3	87
		July 23	33	23	14	9	5	84	33	23	14	9	5	84
14	New York...	Aug. 5	33	23	14	9	5	84	33	23	14	9	5	84
		Aug. 18	32	23	14	9	5	83	32	23	14	9	5	83
	England ...	Aug. 9	38	25	13.5	8.5	3	88	36	25	14	8.5	3	86.5
			36	25	13.5	8.5	3	86	35.5	24	13.5	8.5	3	84.5
16	New York...	Aug. 5	35	24	14	9	5	87	37	24	14	9	5	89
		Aug. 18	34	24	14	9	5	86	36	24	14	9	5	88
	England ...	Aug. 16	34	25	13.5	8	3	87.5	34.5	25	14	7.5	3	88
18	New York...							37.5	25	14	8	3	57.5	
		Aug. 5	35	25	14	9	5	84	38	24	14	9	5	90
		Aug. 18	34	23	14	9	5	85	37	24	14	9	5	89
		Aug. 31	33	23	14	9	5	84	36	24	14	9	5	88
		Sept. 17	33	23	14	9	5	84	36	24	14	9	5	88
		Sept. 29	32	23	14	9	5	83	35	24	14	9	5	87
		Oct. 15	32	23	14	9	5	83	34	24	14	9	5	86
		Oct. 29	31	23	14	9	5	82	33	24	14	9	5	85
		Dec. 6	29	23	14	9	5	80	30	24	14	9	5	82
		Jan. 7	29	23	14	9	5	80	30	24	14	9	5	82
	England ...	Aug. 19	41	25	15	9.5	3	93.5	40.5	25	14.5	9.5	3	92.5
			39	24.5	15	9.5	3	91	40	24.5	15	9.5	3	92
20	New York...	Aug. 18	34	24	15	9	5	87	39	24	15	9	5	92
		Aug. 31	31	24	15	9	5	86	39	24	15	9	5	92
		Sept. 17	33	24	15	9	5	86	38	24	15	9	5	91
		Sept. 29	32	24	15	9	5	85	37	24	15	9	5	90
		Oct. 15	31	24	15	9	5	84	37	24	15	9	5	90
		Oct. 29	31	24	15	9	5	84	35	24	15	9	5	88
		Dec. 6	27	24	15	9	5	80	31	24	15	9	5	84
	England ...	Jan. 7	26	24	15	9	5	79	24	24	15	9	5	81
		Aug. 30	35	25	14	9	3	87	37	25	14.5	8.5	3	88
22	New York...		35	25	14	9	3	86	36	25	14	8	3	86
		Aug. 18	39	24	15	9	4	91	39	24	15	9	4	91
		Aug. 31	38	24	15	9	4	90	38	24	15	9	4	90

Comparison of pasteurized and raw cream butter—Continued.

Shipment No.	Where scored.	Date scored.	Pasteurized.						Raw.					
			Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
12	England....	Sept. 8	38.5	35	14.5	10	3	91	38.5	35	14.5	10	3	91
			36.5	35	14.5	9	3	88	38	35	14	9.5	3	89.5
24	New York...	Aug. 31	40	35	15	10	5	95	41	35	15	10	5	96
		Sept. 17	40	35	15	10	5	95	40	35	15	10	5	95
		Sept. 29	39	35	15	10	5	94	39	35	15	10	5	94
		Oct. 15	39	35	15	10	5	94	39	35	15	10	5	94
		Oct. 29	36	35	15	10	5	91	37	35	15	10	5	92
		Dec. 6	34	35	15	10	5	89	33	34	15	10	5	87
		Jan. 6	33	35	15	10	5	88	32	34	15	10	5	86
	England....	Sept. 8	38	35	15	9.5	4	91.5	40	35	14	9	4	92
			36	35	15	8.5	4	88.5						
26	New York...	Aug. 31	35	24	14	9	5	87	33	24	14	9	5	85
		Sept. 17	34	24	14	9	5	86	32	24	14	9	5	84
		Sept. 29	33	24	14	9	5	85	32	24	14	9	5	84
		Oct. 15	32	24	14	9	5	84	31	24	14	9	5	83
		Oct. 29	32	24	14	9	5	84	31	24	14	9	5	83
		Dec. 6	29	24	14	9	5	81	28	24	14	9	5	80
		Jan. 7	29	24	14	9	5	81	26	24	14	9	5	78
	England....	Sept. 10	38.5	24.5	15	9	4	91	36	24.5	14.5	10	4	89
			35	25	14.5	10	4	88.5	35.5	24.5	14	10	4	88
28	New York...	Sept. 17	35	24	14	9	4	86	33	24	14	10	4	85
	England....	Sept. 23	39.5	25	14.5	10	4	93	36.5	25	14.5	8.5	4	88.5
			38.5	25	14.5	10	4	92	36	25	14.5	9	4	88.5
30	New York...	Sept. 17	39	25	15	10	5	94						
		Sept. 29	39	25	15	10	5	94						
		Oct. 15	38	25	15	10	5	93						
		Oct. 29	37	25	15	10	5	92						
	England....	Oct. 14	39.5	25	15	10	4	93.5						
			38	25	15	10	4	92						
32	New York...	Sept. 29	42	25	15	10	5	97	38	24	15	10	5	92
		Oct. 15	41	25	15	10	5	96	37	24	15	10	5	91
		Oct. 29	40	25	15	10	5	95	35	24	15	10	5	89
		Dec. 6	35	25	15	10	5	90	32	24	14	10	5	85
		Jan. 7	34	25	15	10	5	89	31	24	14	10	5	84
	England....	Oct. 10	40	25	14	8.5	4	91.5	39	25	14.5	9	4	91.5
			38.5	25	14	8.5	4	90						
34	do	Oct. 15	41	24.5	14	10	4	93.5						
			39.5	24	13	9.5	4	90						
36	do	Oct. 22	40.5	24.5	15	10	4	94	40	24	15	9.5	4	92.5
			38.5	24	14	10	4	90.5	39.5	24.5	15	9.5	4	92.5
38	do	Oct. 29							39	24	14.5	9.5	4	91
									37	23.5	14.5	10	4	89
40	do	Nov. 5	39.5	24.5	14.5	9	4	91.5	39	24	14.5	9	4	90.5
			37	24	14.5	9	4	88.5	38.5	24	14.5	9	4	90
42	New York...	Oct. 27							35	24	14	9	5	87
	England....	Nov. 14	40.5	25	15	8.5	4	93	40	25	15	10	4	94
			39	24	15	9	4	91	39	25	15	8	4	91

a Scored after being returned from England.

NOTES UPON APPENDIX XV.

In the report on experimental exports in 1897 the pasteurization of cream for making butter for export was discussed at some length and actual trials were described. The results were favorable to pasteurization. Experiments along this line were continued in the season now being reported upon. The shipments from the Ames College Creamery were of part pasteurized-cream and part raw-cream butter. The differences between the two are well shown by the scores. As was explained in the previous appendix, a sample of each kind of butter in each shipment was kept in New York for scoring, and these were scored at irregular intervals for one, two, or three months. Scores were also recorded in England, and, as above, when several packages were examined by two judges independently, their scores were averaged and the highest and lowest averages are given. Again, the results are slightly in favor of pasteurization. The New York scorings showed that eight times the pasteurized butter arrived in better condition than the raw-cream butter, and six times the reverse was true. The later scores show that the raw-cream butter deteriorated a little more rapidly than the pasteurized.

The English judges made their examinations soon after the shipments arrived; nine times they rated the pasteurized butter ahead of the raw, and five times they gave preference to the raw; in the other shipments they found no difference. On some shipments the report was made that the packages of pasteurized butter were the more uniform in flavor. A Manchester correspondent writes: "It must be remembered that in London they are not so much accustomed to fresh-made, flavory butter as we are in the North, so that the want of flavor in pasteurized butter, to which we object, may not have struck them as being such a fault as it does us. * * * We have come to the conclusion that, as at present understood and generally practiced, we would not advise pasteurization if it causes any trouble or expense."

APPENDIX XVI.

SCORES OF FOREIGN AND HOMEMADE BUTTERS

Shipped to the United States from Liverpool, England, January 7, 1899. Scored at Sioux Falls, S. Dak., January 23, 1899.

Serial number.	Buttry division.	Where made.	Package.	Net weight.	Description.	Score.					Comments of inspectors.	
						Flavor, 50.	Grain, 25.	Color, 10.	Salt, 10.	Style, 5.		Total, 100.
51	1	Denmark	Kiel cask	122	Creamery butter, salted; made about Dec. 30, 1898; bought at Manchester, England, Jan. 2, 1899; cost, 25½ cents per pound, by the package.	44	25	10	10	5	94	Grain fine, a little waxy. Color very light and even. Considerable brine.
52	2	do	do	131.5	Creamery butter, salted; made about Dec. 30, 1898; bought at Manchester, England, Jan. 2, 1899; cost, 25½ cents per pound, by the package.	41	25	10	10	5	91	Do.
53	7	do	Keg	68	Dairy butter, salted; made about Dec. 23, 1898; bought at Manchester, England, Jan. 5, 1899; cost, 2½ cents per pound, by the package.	32.5	23.5	10	10	5	81	Flavor bitter. Grain salty, body somewhat waxy. Brine shows in clear drops.
54	3	Sweden	Kiel cask	120	Creamery butter, salted; made about Dec. 24, 1898; bought at Manchester, England, Dec. 27, 1898; cost, 25½ cents per pound, by the package.	42	25	10	10	5	92	Waxy texture, rather dry.
55	4	Finland	do	122.5	Creamery butter, salted; made about Dec. 14, 1898; bought at Newcastle, England, Dec. 31, 1898; cost, 23½ cents per pound, by the package.	34	25	9	10	5	83	Fishy flavor, apparently due to age. Color streaked. A little water shows on trier.
56	5	Friesland	do	112	Creamery butter, salted; made about Dec. 18, 1898; bought at Manchester, England, Dec. 23, 1898; cost, 22½ cents per pound, by the package.	30	23.5	10	10	5	78.5	Flavor oily and rancid, apparently due to age. Grain salty, overworked. Light color.
57	29	do	Keg	28	Creamery butter, salted; made about Dec. 18, 1898; bought at Manchester, England, Dec. 23, 1898; cost, 22½ cents per pound, by the package.	37.5	25	10	10	5	87.5	Flavor affected by holding, slightly oily. Rather soft, dry. Pale yellow.
58	6	Holland	do	56	Dairy butter, salted; made about Jan. 2, 1899; bought at Manchester, England, Jan. 5, 1899; cost, 23 cents per pound, by the package.	28	23	10	10	5	76	Less colored than Australian butter. Flavor oily, rancid and bitter. Grain salty, overworked. Light color.
59	13	France	Basket	28	Dairy butter, probably factory blend; made in Brittany Dec. 24, 1898; bought in London, England, Jan. 2, 1899; cost, 28½ cents per pound, by the package.	25.5	22	9	10	5	1.5	Flavor unclean, affected by holding. Grain greasy. Color waxy. Very dry, even crumbly, no drops of water. Wrapped in white cotton cloth and covered with straw.
60	28	do	Box	24	Fresh rolls (2-pound), dairy, unsalted; made about Dec. 23, 1898; bought at London, England, Jan. 2, 1899; cost, 2¼ cents per pound, by the package.	35	24.5	10	10	5	84.5	Flavor oily and bitter. Grain salty. Very dry, mealy. Color of newly planed pine board.

Scores of butter exported—Continued.

Shipment No.	(creamery mark)	American (In New York).							Foreign.						
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
57	L								Feb. 21	39.5	25	15	10	5	94.5
										38.5	25	15	10	5	93.5
58	L								Mar. 9	41	25	15	10	5	96
										30	25	15	10	5	94
59	L								Mar. 10	41.5	25	15	10	5	96.5
										40	25	15	10	5	95
60	L								Mar. 16	41.5	25	15	10	5	96.5
										39	25	15	10	5	94
61	L								Mar. 22	41	25	15	10	5	96
										40	25	15	10	5	95
62	L								Mar. 29	41	25	15	10	5	96
										40	25	15	10	5	95
63	L								Apr. 6	40	25	15	10	5	95
										38	25	15	10	5	93
64	L								Apr. 12	40	25	15	10	5	95
										39	25	15	10	5	94
65	L								Apr. 18	37	25	15	10	5	92
										35	25	15	10	5	90
66	L								Apr. 27	40	25	15	10	5	95
										30	25	15	10	5	94
67	L								May 3	40	25	15	10	5	95
										30	25	15	10	5	94
68	L	Apr. 25	34	24	12	8	5	83	May 10	30	25	15	10	5	94
										30	25	15	10	5	94
7	F	July 7	40	25	14	10	5	91	July 11	45	25	15	10	5	100
		July 14	30	25	14	10	5	93							
9	F	July 14	42	25	15	10	5	97	Aug. 11	35	25	10	10	5	85
11	F	July 23	30	25	15	10	5	91	Aug. 5	45	25	15	10	5	100
		Aug. 5	38	25	15	10	5	93		40	25	15	10	5	95
		Aug. 18	37	25	15	10	5	92							
13	F	July 23	39	25	15	10	5	94	Aug. 12	44	25	14.5	10	5	98.5
		Aug. 5	39	25	15	10	5	92							
		Aug. 18	38	25	15	10	5	93							
15	F	Aug. 5	37	25	15	10	5	92	Aug. 22	45	25	14.5	10	5	99.5
		Aug. 18	37	25	15	10	5	92							
17	F	Aug. 5	37	24	15	10	5	91							
		Aug. 18	36	24	15	10	5	90							
		Aug. 31	35	24	15	10	5	89							
19	F	Aug. 18	37	25	15	10	5	92							
		Aug. 31	36	25	15	10	5	91							
		Sept. 17	35	25	15	10	5	90							
		Sept. 29	34	25	15	10	5	89							
		Oct. 15	33	25	15	10	5	88							
		Oct. 29	32	25	15	10	5	87							

a Flavor irregular, some packages bitter, body salty, color too light, salt too light. Manchester criticism was: Flavor foldery, grain excellent, color rather pale, salting right.

b Mottled.

c Rolls.

d Shows no flavor.

Scores of butter exported—Continued.

Shipment No.	Creamery mark.	American (in New York).							Foreign.						
		Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.	Date scored.	Flavor, 45.	Body, 25.	Color, 15.	Salt, 10.	Style, 5.	Total, 100.
21	F	Aug. 18	38	25	15	10	5	93							
		Aug. 31	38	25	15	10	5	93							
		Sept. 17	38	25	15	10	5	93							
		Sept. 29	37	25	15	10	5	92							
		Oct. 15	37	25	15	10	5	92							
		Oct. 29	37	25	15	10	5	92							
23	F	Aug. 31	41	25	15	10	5	96							
		Sept. 17	39	25	15	10	5	94							
		Sept. 29	38	25	15	10	5	93							
		Oct. 15	38	25	15	10	5	93							
		Oct. 29	37	25	15	10	5	92							
25	F	Aug. 31	41	25	15	10	5	96							
		Sept. 17	40	25	15	10	5	95							
		Sept. 29	39	25	15	10	5	94							
		Oct. 15	39	25	15	10	5	94							
		Oct. 29	38	25	15	10	5	93							
27	F	Sept. 17	39	25	15	10	5	94							
		Sept. 29	39	25	15	10	5	94							
		Oct. 15	39	25	15	10	5	94							
		Oct. 29	37	25	15	10	5	92							
29	F	Sept. 17	39	25	15	10	5	94							
		Sept. 29	39	25	15	10	5	94							
		Oct. 15	38	25	15	10	5	93							
		Oct. 29	36	25	15	10	5	91							
41	F	Oct. 27	39	25	15	10	5	94							
1	S	Apr. 27	41	25	15	10	5	96							
3	S	May 25	41	25	15	10	5	96							
		July 7	40	25	15	10	5	95							
		July 14	39	25	15	10	5	94							
7	S	June 21	40	25	15	10	5	95	July 11	40	25	15	5	0	85
		July 7	34	24	14	10	5	87		38	25	15	5	0	83
		July 14	33	24	14	10	5	86							
9	S	July 13	40	25	15	10	5	95	Aug. 11	25	25	6	6	0	62
		July 23	38	24	11	9	5	87							
11	S	Aug. 5	38	25	15	10	5	93							
		Aug. 18	37	25	15	10	5	92							
51	S	July 28	41	25	15	10	5	96	Aug. 18	27	25	15	5	0	72
2	B	May 19	40	25	15	10	5	95	May 27	32	24.5	12.5	9	3	81
		July 7	37	25	15	10	5	92		28.5	24	13	10	3	78.5
		July 14	36	25	15	10	5	91							

a June 21, graded creamery extras; July 7, sour and milky; July 14, ditto. London criticism: Flavor show slight rancidity too much salt, tubs objectionable.

b July 3, graded as creamery extras; July 23, shows loss in flavor, body affected by mottles, salt too high. Hamburg criticism: Decidedly inferior, flavor old, too much moisture and salt, milk not washed out, color mottled and too high.

Too salt and too much moisture; milk not washed out properly.

d May 19, has slight burnt flavor July 7 and 14, burnt and bitter. Manchester criticism: Well bodied butter, robust in make, but rather coarse in grain, quite spoiled by peculiar resinous flavor, which could scarcely be attributed to the "pinney" odor of boxes; probably fault of cream ripening.

NOTES UPON APPENDIX XVI.

In January, 1899, twenty-eight packages of foreign butters were imported from England and exhibited at the convention of the National Creamery Buttermakers' Association at Sioux Falls, S. Dak. These butters were purchased by an agent of the Department of Agriculture, assisted by interested London and Manchester merchants, and each package was supposed to be a good representative of its class in the market at that time. Samples of butter from all countries whose products were on sale when the purchases were made were obtained, and this collective lot attracted considerable attention at the butter makers' convention.

The scores given are the averages of opinions of two well-known American judges. The "comments of inspectors" includes opinions of several judges. The scale was the same as used in the competitive exhibit at the convention, and differs from the one used in judging the foreign butters which were noted in the report of experimental exports in 1897. This fact should be kept in mind if the two lots are compared. It is not necessary to make extended comment upon the scores. By reference to the table the remarkably fine quality of the best selling butters will be seen, and although these were often made for early use, it will be noticed that they were capable of being held a considerable time and shipped long distances without greatly impairing their quality. Each sample which scored above 90 and several others were deficient in flavor only.

The principal criticisms of flavor were that it was bitter, rancid, or unclean. Sometimes it was lacking. With one exception all the samples from Australia were criticised as oily and fishy. These defects were usually attributed to long keeping. Some butters were scored off on account of salvy grain, but more than half of the samples were marked "Perfect" on grain. On color all were perfect but six, which were wavy or mottled. Only one sample was scored off on salt. The packages were uniformly satisfactory. They were of many different styles, but always well made from strong materials.

For purposes of comparison, four boxes of States butter—two from Minnesota and two from Wisconsin—were returned in the lot sent from Liverpool, and when allowance is made for their unsatisfactory color, which could easily be remedied, it is seen that they, two of them especially, stood the doubly long journey remarkably well. The scores of the two prize-winning tubs at the convention are also given.

APPENDIX XVII.

CHEMICAL ANALYSES OF BUTTER EXPORTED.

The butter sampled.			Analyzed.		Report of analysis.			
Shipment number.	Creamery mark.	Where made.	Where.	When.	Water.	Fat.	Curd.	Ash.
				1898-99.	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
X	N	Wisconsin	Wisconsin	July	12.12	85.89	.70	1.29
XIV	N	do	do	do	12.33	85.36	.79	1.52
XX	N	do	do	August	13.25	84.50	.74	1.51
XXII	N	do	do	do	12.77	84.99	.64	1.60
XXX	N	do	do	September	13.18	84.55	.81	1.46
XXXIV	N	do	do	do	12.43	85.49	.66	1.42
XXXVIII	N	do	do	October	12.29	84.75	.90	2.06
XLII	N	do	do	do	11.60	86.42	.83	1.15
XLIV	N	do	do	November	11.44	85.50	.94	2.12
XLVI	N	do	do	December	10.03	86.80	1.33	1.84
XLVIII	N	do	do	do	14.93	82.55	1.11	1.41
L	N	do	do	January	11.96	85.61	.96	1.47
LIII	N	do	do	do	13.11	82.63	.83	3.43
LV	N	do	do	February	12.29	84.32	1.06	2.33
LVII	N	do	do	do	13.99	81.05	1.63	3.93
LIX	N	do	do	March	9.46	88.04	1.01	1.49

Chemical analyses of butter exported—Continued.

The butter sampled.			Analyzed.		Report of analysis.			
Shipment number.	Creamery mark.	Where made.	Where.	When.	Water.	Fat.	Curd.	Ash.
				1898-99.	Per ct.	Per ct.	Per ct.	Per ct.
LXI	N	Wisconsin	Wisconsin	March	14.43	80.18	1.20	4.19
LXIII	N	do	do	April	14.09	81.05	1.23	3.63
LXV	N	do	do	do	12.23	83.31	.96	3.50
XIX	L	Minnesota	Minnesota	August	10.01	86.95	1.03	2.01
XXXIII	L	do	do	October	13.90	84.11	.62	1.37
XXXVII	L	do	do	do	14.14	83.87	.57	1.42
XLV	L	do	do	November	12.86	84.68	.91	1.55
I	L	do	do	December	12.32	85.40	.86	1.42
I	A	Iowa	Iowa	May	11.21	85.70	1.28	1.81
I	a A	do	do	do	8.40	89.08	1.03	1.49
II	A	do	do	do	10.83	86.12	1.45	1.60
II	a A	do	do	do	12.58	84.13	1.43	1.86
IV	A	do	do	June	10.07	86.94	1.14	1.85
IV	a A	do	do	do	6.72	91.23	1.16	.89
VIII	a A	do	do	July	7.65	90.21	.80	1.34
X	A	do	do	do	8.80	88.64	.91	1.65
X	a A	do	do	do	7.38	90.62	1.37	1.23
XII	A	do	do	August	10.73	86.35	1.12	1.80
XII	a A	do	do	do	8.90	88.94	.78	1.38
XIV	A	do	do	do	8.73	88.99	1.10	1.18
XIV	a A	do	do	do	9.42	88.17	1.22	1.19
II	B	do	do	May	10.44	86.13	1.70	1.73
IV	B	do	do	June	8.13	90.18	.68	1.01
VII	B	do	do	July	11.17	86.78	1.22	.83
XI	B	do	do	do	8.77	88.59	1.07	1.57
V	D	Vermont	Vermont	August	10.48	84.17	.56	4.79
LI	D	do	do	do	11.81	85.33	.55	2.31
Average of 19 "N" samples					12.52	84.37	.93	2.18
Average of 5 "L" samples					12.65	85.00	.80	1.55
Average of 13 "A" samples					9.34	88.04	1.14	1.48
Average of 4 "B" samples					9.63	87.92	1.17	1.28
Average of 2 "D" samples					11.14	84.75	.56	3.55
Average of all (43) samples					11.24	85.90	.98	1.88

a Made from pasteurized cream.

NOTES UPON APPENDIX XVII.

The above analyses were made at the experiment stations in the States named. It will be seen that, without exception, the butters which were sent abroad were of fine quality, so far as analysis can show. The amount of moisture was low and fat correspondingly high. In no case was there more than 15 per cent water, and only four samples showed more than 14 per cent. On the other hand, eleven contained less than 10 per cent, the lowest of which was a pasteurized lot from Ames, Iowa, with only 6.72 per cent water. The average water content of the 43 analyses was 11.24.

The fat content varies almost inversely with water, the maximum, 91.23 per cent, being in the sample having least water. The average of all shows 85.9 per cent fat, which is a good market standard. The small amount of curd indicates superior keeping qualities. The variation in salt was evidently not as noticeable to the judges as it would seem from the analyses it would be. It was aimed to have the butter contain about 2½ per cent salt.

Analyses were not made in England as in 1897, hence it is impossible to compare the composition of the butters just after leaving the creamery and just before being sold.

APPENDIX XVIII. ANALYSES OF FOREIGN-MADE BUTTERS.

No.	Dairy Division No.	Where made.	Analyses of butters.				Analyses of fats.							
			Water.	Fat by diffusion.	Cassia, sugar, etc.	Ash and salt.	Salt.	Melting point.	Reichert-Meisel number.	Saponification number.	Iodin number.	Insoluble acids.	Soluble acids.	Free acid number.
51	1	Denmark	12.65	84.63	1.09	1.63	1.52	33.5	32.1	230.2	32.2	87.85	5.92	3.1
52	2	do	14.27	83.13	1.27	1.33	1.20	35.0	31.7	231.3	31.3	88.13	6.05	5.0
53	7	do	15.14	81.67	1.30	1.89	1.83	33.0	30.6	230.0	32.4	88.33	6.13	3.2
54	3	Sweden	13.20	84.22	1.02	1.56	1.46	32.2	29.7	230.0	39.5	88.53	5.52	3.2
55	4	Finland	12.45	84.76	1.08	1.71	1.61	33.5	29.2	228.5	31.2	88.40	5.47	3.2
56	5	Friesland	13.47	82.82	1.39	2.35	2.22	34.0	28.7	231.1	38.6	88.46	6.42	2.0
57	29	do	12.80	84.66	1.45	1.00	.97	34.5	25.5	223.2	38.1	89.22	4.54	0.7
58	6	Holland	12.34	84.72	1.04	1.00	1.82	33.7	30.9	222.9	31.1	88.31	4.73	2.8
59	13	France	17.64	80.05	1.80	a .51	.11	34.2	25.5	225.7	33.9	89.21	5.01	14.8
60	28	do	15.46	82.93	1.20	a .41		33.5	27.8	224.1	36.2	89.04	5.01	8.4
61	28A	Italy	14.41	83.95	1.40	a .24		34.0	28.2	230.0	32.2	88.70	5.48	6.6
62	27	England	14.25	84.81	.37	a .57	.52	33.5	29.3	227.1	33.2	88.86	5.40	5.3
63	8	Ireland	11.48	84.92	1.08	2.52	2.45	34.8	31.3	226.2	40.5	88.36	5.91	1.8
64	9	do	15.96	79.92	1.45	a 2.67	2.31	35.3	25.1	223.0	37.5	89.61	5.03	2.6
65	10	do	19.10	70.59	1.67	8.64	8.28	36.0	20.5	223.1	39.1	89.34	5.29	1.8
66	11	do	14.18	84.49	.98	a .35	.24	35.0	20.5	219.9	39.1	90.66	4.29	7.6
67	12	do	13.00	83.65	.96	2.09	2.05	35.0	21.0	219.1	39.6	90.73	4.12	5.5
68	25	do	12.96	84.18	1.18	a 1.68	1.35	33.5	23.0	226.6	35.4	89.40	5.29	3.0
69	26	do	12.60	84.36	1.34	a 1.70	1.33	33.0	29.3	227.6	35.6	89.11	5.45	3.4
70	20	Canada	10.25	86.89	1.15	1.71	1.64	34.5	27.1	227.3	39.7	89.19	4.91	2.8
71	21	do	11.81	85.03	.95	2.21	2.17	33.5	27.5	228.0	34.1	89.36	5.14	2.0
72	14	Australia	10.09	85.86	.93	a 2.52	2.42	35.5	30.9	226.7	37.0	88.57	5.75	1.5
73	15	do	10.38	86.63	.89	a 2.10	1.98	34.5	31.2	227.3	35.7	88.56	6.09	1.8
74	17	New South Wales	11.40	85.03	1.16	a 2.41	1.94	33.7	32.3	231.2	37.3	88.00	6.12	1.0
75	18	do	11.49	85.62	1.13	a 1.86	1.47	34.0	32.3	235.1	33.6	88.13	6.05	.9
76	22	Victoria	12.44	84.75	1.09	a 1.72	1.46	34.0	32.3	235.5	30.8	87.80	6.11	1.4

77	19	New Zealand	11.95	83.01	.70	0.174	1.51	152.7	220.0	377.3	87.02	0.05	7
78	20	Argentina	12.39	84.80	.78	0.198	1.72	31.6	231.2	377.5	88.54	0.17	7
		Average of 20 foreign	12.22	83.75	1.14	1.89	1.70	34.0	227.6	384.8	88.70	0.50	3.7
79	23	Wisconsin	12.69	84.28	1.05	1.79	1.76	34.5	229.6	390.0	88.55	5.50	3.7
80	23A	do	13.08	82.96	.94	3.02	2.97	33.0	229.3	391.5	88.46	5.42	1.5
81	24	Minnesota	13.57	84.32	.78	1.33	1.22	34.5	231.1	327.9	88.87	5.30	4.8
82	24A	do	13.21	84.68	.93	1.18	1.11	34.5	229.4	327.7	88.79	5.33	4.3
		Average of 4 States	13.19	84.06	.93	1.83	1.77	34.6	229.5	391.8	88.67	5.37	3.3

a Found to contain boric acid preservative.

NOTES UPON APPENDIX XVIII.

These analyses were made in the Division of Chemistry of the Department of Agriculture. For descriptions and scores of the different samples, see Appendix XVI. By comparing the above analyses with the analyses of a larger number of States samples in Appendix XVII it will be seen that in the latter there is less variation, also that the States butters averaged practically 2 per cent less in water, 2.15 per cent more in fat, and 0.15 per cent less in curd. The water content of the best foreign butters varies considerably. It is low in most butters from the far countries, Canada and Australia, the minimum being 10.25 per cent in Canadian. The minimum and maximum in Danish samples are, respectively, 12.65 and 15.14. Five of the 28 butters contain more than 15 per cent water. In one sample of Irish butter there was over 19 per cent of water, and this same sample had a remarkably high salt content; in some countries it would be considered badly adulterated. The French and Italian unsalted butters contained a considerable amount of moisture and yet appeared unusually dry.

The use of preservatives in 15 of the 28 foreign butters is worthy of note. All the samples from Australia, the two from France, the single ones from New Zealand, Argentina, Italy, and England, and four

of the seven from Ireland were found to contain boric acid. The others contained no preservatives.

The melting points were determined after the samples had become more or less rancid, and it is possible they were very slightly affected on this account. The States butters prepared for export compare well with the others in this respect.

In commenting on the analyses, Dr. H. W. Wiley, chief chemist, writes:

"The percentages of volatile acids in the samples were mostly normal. In two instances these percentages fell sufficiently below the normal to engender the suspicion of their genuineness, namely, Nos. 11 and 12. Many instances are on record where the butter from a single cow has been found to have as low a percentage of volatile acids as that indicated in the data mentioned above. It is quite unusual, however, in butter made from a mixed herd to find the percentage of volatile acid so low. * * * The free-acid number indicates the number of milligrams of potassium hydrate required to neutralize the free acid in one gram of the fat. The numbers in this column are evidently very much higher than they would have been had the determinations been made when the samples were perfectly fresh. It will be noticed that there is a general agreement between the Reichert-Meißl numbers and the saponification numbers."

DAIRY DEVELOPMENT IN THE UNITED STATES.¹

By HENRY E. ALVORD, C. E.,
Chief of Dairy Division, Bureau of Animal Industry.

THE PRESENT FIELD OF THE DAIRY INDUSTRY.

No branch of agriculture in the United States has made greater progress than dairying during the nineteenth century. No other has received more direct benefit from the art of invention, the teachings of modern science, and the intelligent practice of skilled operators. Cooperative and commercial organizations have been formed to conduct the business locally and to guard its general interests. State laws and appropriations of money have been made to foster and promote this industry. Dairying has become the specialty of districts of wide area in different parts of the country. It is now regarded as among the most progressive and highly developed forms of farming in the United States.

The greater part of this country has been found so well adapted to dairying that its extension has more than kept pace with the opening and settlement of new territory. A belief was long entertained that successful dairying in America must be restricted to narrow geographical limits, constituting a "dairy belt" lying between the fortieth and forty-fifth parallels of latitude and extending from the Atlantic Ocean to the Missouri River; the true dairying districts were thought to be in separated sections, occupying not more than one-third of the area of this belt. These ideas have been exploded. It has been proved that good butter and cheese can be made, by proper management, in almost all parts of North America. Generally speaking, good butter can be made wherever good beef can be produced. Advantages unquestionably exist in the climate, soil, water, and herbage of certain sections, but these factors are largely under control, and what is lacking in natural conditions can be supplied by tact and skill. So that, while dairying is intensified, and constitutes the leading agricultural interest over large areas where the natural advantages are greatest, the industry is found well established in spots in almost all parts of the country and developing in unexpected places and under what might be considered as very unfavorable conditions.

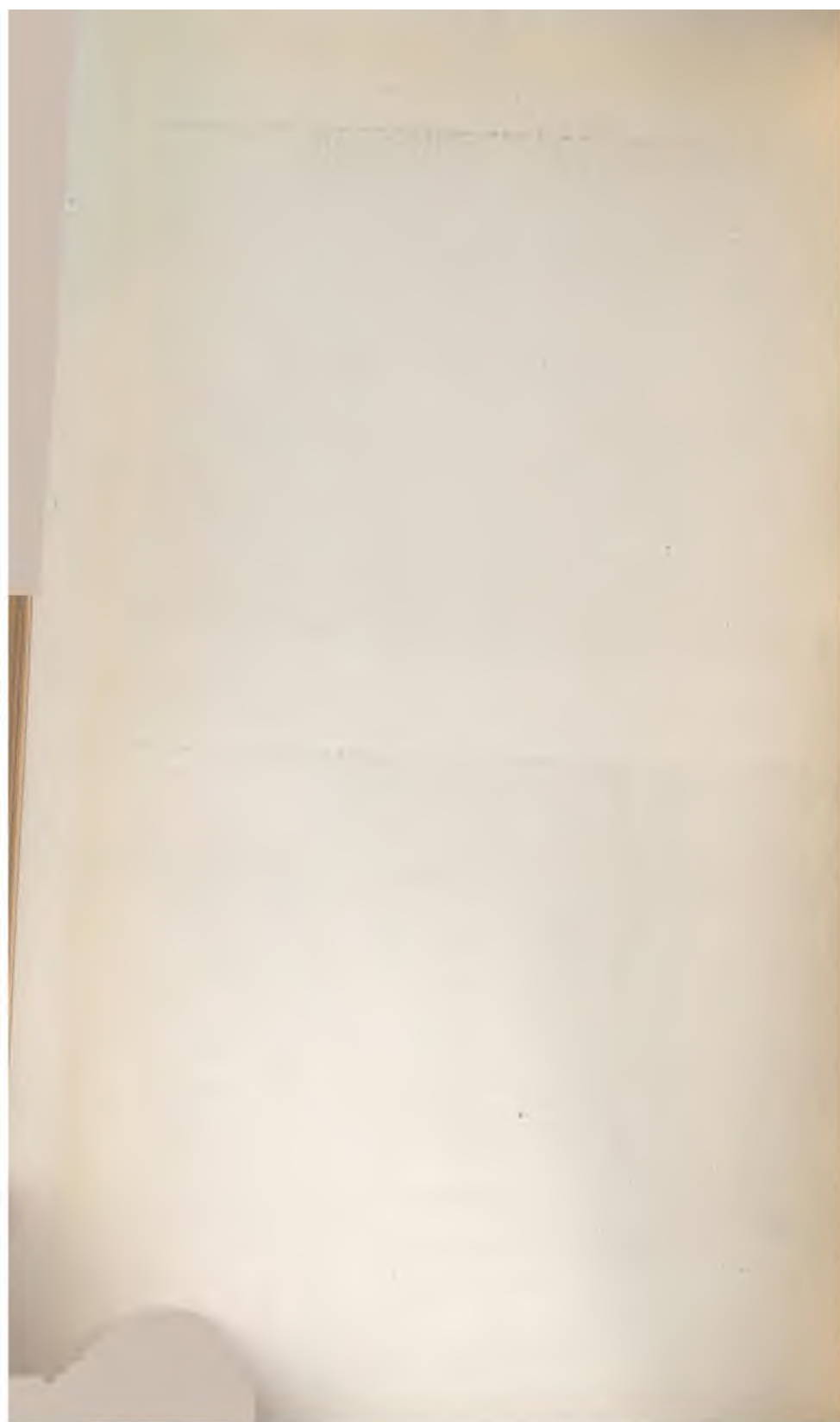
¹This article also appears in the Yearbook of the Department of Agriculture for 1899.



FIG. 1.—BUTTER MAKING—THE OLD WAY.



FIG. 2.—BUTTER MAKING—THE NEW WAY.



DAIRYING DURING THE COLONIAL PERIOD AND AT THE PRESENT TIME.

Dairying was practiced in this country in colonial times, and butter and cheese are mentioned among the early exports from the settlements along the Atlantic coast; but this production was only a feature of general and pioneer farming. Dairying as a specialty did not appear in the United States to any extent until well along in the nineteenth century. The dairy history of the country is therefore identical with its progress in the present century. This progress has been truly remarkable. The wide territorial extension; the immense investment in lands, buildings, animals, and equipment; the great improvement in dairy cattle; the acquisition and diffusion of knowledge as to economy of production; the revolution in methods and systems of manufacture; the general advance in quality of products; the wonderful increase in quantity; the industrial and commercial importance of dairying, all constitute a prominent feature in the material progress of the nation.

DAIRYING DURING THE EARLY PART OF THE CENTURY.

During the early part of the century the keeping of cows on American farms was incident to the general work. The care of milk and the making of butter and cheese were in the hands of the women of the household, and the methods and utensils were crude. The average quality of the products was inferior. The supply of domestic markets was unorganized and irregular. The milch cows in use belonged to the mixed and indescribable race of "native" cattle, with occasionally a really good dairy animal appearing singly, almost by accident, or, at the best, as one of a family developed by some uncommonly discriminating yet unscientific breeder. The cows calved almost universally in the spring, and were generally allowed to go dry in the autumn or early winter. Winter dairying was practically unknown. As a rule, excepting the pasture season, cattle were insufficiently and unprofitably fed and poorly housed, if at all. It was a common thing for cows to die of starvation and exposure, and it was considered no disgrace to owners to have their cattle "on the lift"¹ in the spring. In the Eastern and Middle States the milk was usually set in small shallow earthen vessels or tin pans for the cream to rise. Little attention was paid to cooling the air in which it stood in summer or to moderating it in winter so long as freezing was prevented. The few who scalded fresh milk had no idea of the true reason for so doing or why beneficial effects resulted. The pans of milk oftener stood in pantries and cellars or on kitchen shelves than in rooms specially constructed or adapted to the purpose. In southern Pennsylvania and the States farther south spring houses were in vogue; milk received

¹ A common expression in years past in some localities, indicating the actual necessity of human aid to raise emaciated animals to their feet.

care, and setting it in earthen crocks or pots, standing in cool, flowing water, was a usual and excellent practice. Churning the entire milk was very common. This is still done to some extent in the Southern States, where butter is made every morning and where all the milk is buttermilk. In seasons of scarcity of milk there was no butter. In the Northern States there were some instances where families were supplied with butter weekly during most of the year, and with an occasional cheese, directly from the producers. But the general farm practice was to "pack" the butter in firkins, half firkins, tubs, and jars, and let the cheese accumulate on the farm, taking these products to market only once or twice a year. Not only were there as many different lots and kinds of butter and cheese as there were producing farms, but the product of a single farm varied in character and quality according to season and other circumstances. Every package had to be examined, graded, and sold upon its merits. It was usual for half the butter in market to be strong, if not actually rancid, and for cheese to be sharp. With the products largely low in grade, prices were also very low. (Pl. IV.)

DAIRYING DURING THE MIDDLE OF THE CENTURY.

The above conditions continued without material change up to the middle of the century. Some improvement was noticeable in cattle and appliances, and in some sections dairy farming became a specialty, although not in a marked degree. Herkimer County, N. Y., is probably the best example of early dairy districts in this country. Of this county N. A. Willard wrote (in 1870) as follows:

Cheese making began here more than sixty years ago. For upward of twenty years its progress was slow and the business was deemed hazardous by the majority of farmers, who believed that overproduction was to be the result of making a venture upon this specialty. The fact, however, gradually became apparent that the cheese makers were rapidly bettering their condition and outstripping in wealth those who were engaged in grain raising and a mixed husbandry. About the year 1830 dairying became general in the towns of Herkimer County north of the Mohawk, and some years later spread through the southern part of the county, gradually extending into Oneida and adjoining counties. Up to this period and for several years later little or no cheese was shipped to Europe. It was not considered fit for market till fall or winter. It was packed in rough casks and peddled in the home market at 5 to 8 cents a pound.

All the operations of the dairy continued rude and undeveloped even in these "dairying districts." The cows were milked in the open yard, and the curds were worked in homemade tubs and pressed in log presses. Everything was done by guess; there was no order, no system, no science in dairy operations. The cheese-making section gradually embraced the central and western portions of New York and the adjacent parts of Pennsylvania and Ohio, and the total production became large. Toward the middle of the century the

gross supply of cheese was in excess of domestic demand, and cheese exports from the United States, mainly to Great Britain, ranged from 3,000,000 to 17,000,000 pounds a year. With the growth of cities and towns the business of milk supply increased and better methods prevailed. Yet, prior to the year 1850 no city had received any part of its milk supply by railroad transportation; near-by producers met all existing demands by hauling in their own vehicles. Butter making for home use and in a small way for local trade was common wherever cows were kept, and in some places there was a surplus sufficient to be sent to the large markets. Vermont and New York became particularly noted for butter production. "Franklin County butter," from counties of this name in those two States and in Massachusetts, was the favorite in New England markets, and the fame of "Orange County" and "Goshen" butter, from southern New York, was still more extensive.

DAIRYING DURING THE THIRD QUARTER OF THE CENTURY.

The twenty-five years following 1850 was a period of remarkable activity and progress in the dairy interests of the country. At first the agricultural exhibitions or "cattle shows," which were comparatively new and popular, and the enterprise of importers turned attention toward the improvement of farm animals; breeds of cattle noted particularly for dairy qualities were introduced and began to win the favor of dairy farmers. Then the early efforts at cooperation in dairying were recognized as successful, and were copied until the cheese factory became an established institution. Once fairly started in the heart of the cheese-making district of New York, the factory system spread with much rapidity. The "war period" lent additional impetus to the forward movement. The price of cheese, which was 10 cents per pound and less in 1860, rose to 15 cents in 1863 and to 20 cents and over in 1865. The foreign demand increased also, and the yearly cheese exports rose from 10,000,000 pounds in 1850 to 15,000,000 in 1860 and to almost 50,000,000 in 1865. Ten years later over 100,000,000 pounds were exported.

ESTABLISHMENT OF CHEESE AND BUTTER FACTORIES.

Although several earlier instances of associated dairying have been authenticated, which were locally successful, it is generally conceded that the credit of establishing the first real cheese factory, which served as a model and incentive to others (fig. 2), belongs to Jesse Williams, of Oneida County, N. Y. Mr. Williams lived upon his farm, near Rome. He was an experienced and skillful cheese maker, and his dairy had such a good reputation and its product was so eagerly sought at prices above the average that he increased his output of cheese by adding to his own supply of milk that from the herd of a

son, located upon a farm near by, and then from other neighbors. This idea of bringing together daily the milk from several neighboring farms, to be made into cheese at one place by a skilled operator, was

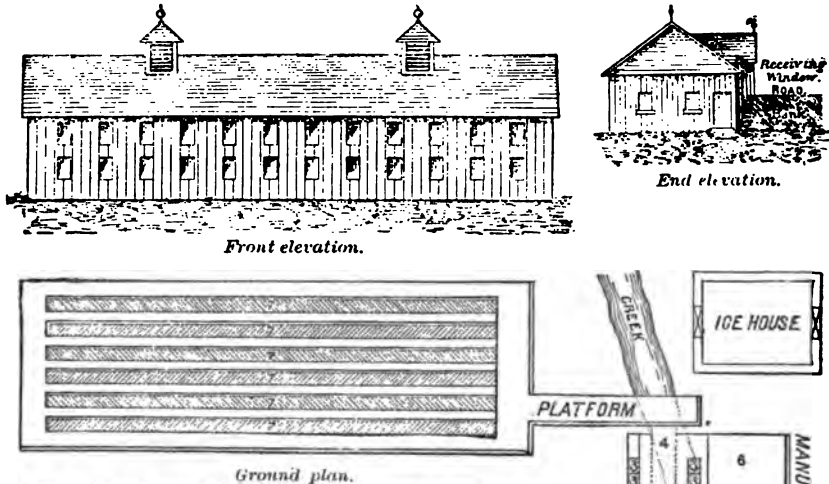


FIG. 2.—Elevations and plan of one of the first cheese factories built in the United States.

the germ from which sprang the cheese factory system of the United States. Mr. Williams began working on this plan in 1851. He was so successful that a special building was erected the next year and fitted up with the best apparatus obtainable. The effect of this good example and the early extension of the factory system is shown by the following table, which gives the number of factories built and put into operation in New York annually during the years stated:

Number of cheese factories established in the State of New York annually, 1854-1866.

Year.	Factories.	Year.	Factories.
1854.....	4	1862.....	25
1855.....	2	1863.....	111
1856.....	3	1864.....	210
1857.....	3	1865.....	52
1858.....	4	1866.....	46
1859.....	4	Total in 1866...	490
1860.....	17		
1861.....	18		

Cheese factories were soon started in Pennsylvania and Ohio, and then in other States, East and West. In 1869 the number in the whole country exceeded 1,000, and from that time the cooperative, or factory, system practically superseded the making of cheese on farms.

Making butter in quantity from milk or cream collected from numerous farms soon followed as the next advance in American dairying. Such establishments are properly butter factories, but the name of "creamery" has been generally adopted, and is not likely to be changed. The first creamery was built by Alanson Slaughter, near Wallkill, Orange County, N. Y., in the year 1861. The milk from 375 cows was received here daily. In Illinois the first cheese factory was started in 1863 and the first creamery in 1867. In Iowa these respective dates were 1866 and 1871. During the earlier years of their operation it was quite common for both butter and cheese to be made at the creameries at different times, or butter and skim cheese at the same time.

SOME FEATURES OF THE FACTORY SYSTEM OF DAIRYING.

The effect of the establishment of cheese and butter factories, comparatively new in kind, is to transfer the making of butter and cheese from the farm to the factory. Originating in this country, although now extensively adopted in others, the general plan may be rightly called "the American system of associated dairying." It constitutes one of the notable and important landmarks in the progress of dairying during the present century. The early cheese factories and creameries were purely cooperative concerns, and it is in this form that the system has usually extended into new territory, whether for the production of butter or cheese. The cow owners and producers of milk cooperate and share, upon any agreed basis, in organizing, building (or renting and refitting), equipping, and managing the factory and disposing of its products. The farmers interested as joint owners, and all who contribute milk or cream, are called the patrons. The operations are managed by a committee or board of directors chosen by and from the patrons. If the business is large enough to warrant the expense, the immediate supervision of the concern and all its interests is intrusted to a single manager, employed by the board. In a factory of this kind all expenses are deducted from the gross receipts from sales and the remainder is divided pro rata among the patrons upon the basis of the raw material contributed. Another plan is for the plant to be owned by a joint stock company, composed largely, if not wholly, of farmers, and milk or cream is received from any satisfactory producer. In this case interest on the property or capital is usually allowed and included in the current expenses. The management is otherwise the same; the stockholders receive a fixed rate of interest on their investment and the dividends to patrons depend upon their deliveries of milk or cream and the fluctuations of the market for the factory products. The proprietary plan is also common, being managed much like any other factory; the proprietor or company buys the milk or cream from the producers at prices mutually agreed upon from time to time and assumes all the expenses, risks, and returns of

the business. Another way is for the factory, whether owned and managed by a company of farmers (probably themselves patrons) or by outsiders, to bear all expenses, make and sell the butter and cheese at a fixed charge per pound, and divide the net proceeds of sales as on the purely cooperative plan. All these plans are varied and modified in practice. Fig. 3 shows the ground plan of the first creamery in this country.

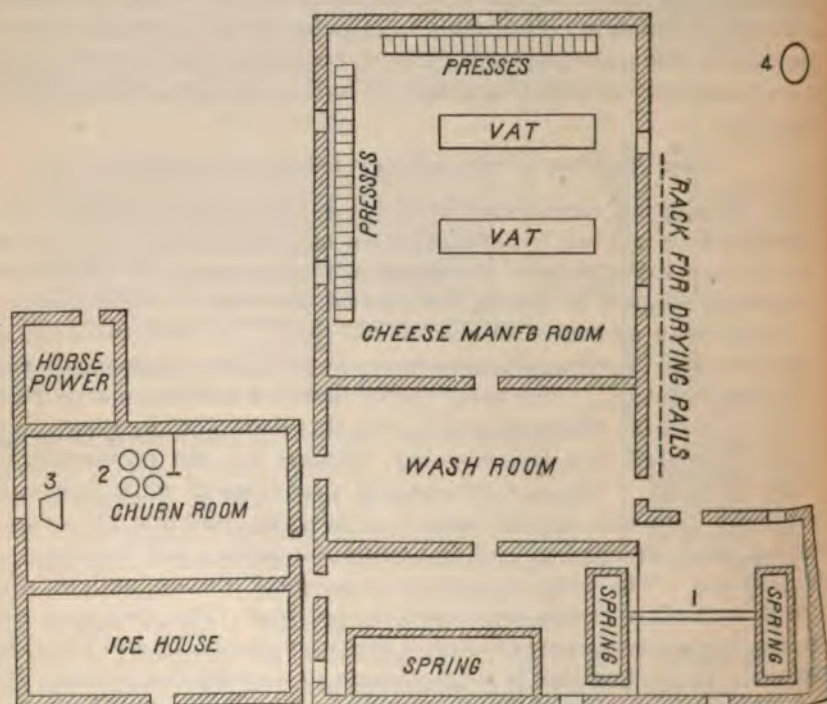


FIG. 3.—Ground plan of the first creamery, or butter factory, in the United States (provided for cheese making included): 1, water pipe; 2, churns; 3, butter worker; 4, whey cistern.

METHODS OF MANAGEMENT OF CHEESE AND BUTTER FACTORIES.

Independent of the matters of ownership, organization, and control, the factories and creameries differ much in methods of management and of settlement with patrons. Great progress in these particulars has been made since the introduction of the system. The first establishments received milk from patrons daily and sometimes twice a day. From near-by farms the milk was often warm from the cow at time of delivery. The milk was then kept in large vats (for cheese making) or in immense shallow pans in a cooling and creaming room until skimmed. Abundant room and expensive receptacles were necessary at the creamery. Then, for butter making, deep setting of the milk in cool water was adopted. The creameries were provided with

pools or stationary vats below the floor level. Through these, cool water flowed from springs near at hand, and in them the milk was set in "shotgun" cans (fig. 4), immediately after arrival, for cooling and for cream to form. The pools were 18 or 20 inches deep, with racks at bottom to hold cans. The tin cans were 22 inches deep and 8 inches in diameter and filled so that when in the pool the top of the milk was just below the surface of the water. Springs with abundant flow and having a natural temperature of 48° to 56° F. were regarded as highly desirable. Afterwards came the method of mechanical cream separation (to be later described) in place of "setting" or the gravity system. Another radical change, which began about 1875, was to set and skim the milk on the farms and haul only cream to the factories. Agents from the creameries, with suitable teams and carrying cans, drove from farm to farm and gathered the cream. Hence, the name of "gathered-cream factories" for establishments of this class. This kind of factory is still the favorite in some good butter districts, and it has very decided merits. The earliest factories and creameries paid for milk by the quart or gallon and at the same price, all lots of equal bulk being regarded of equal value. The first step in advance on this line was to buy or credit milk by weight, but still all at the same price. On the gathered-cream plan, equal bulk measures of cream were long regarded as of like value, and this is still practiced to some extent. The most modern and approved plan is to pay for the milk or cream received by factory or creamery according to the pounds of fat it actually contains as experimentally determined. This will be referred to later. At first it was considered sufficient to have 200 cows tributary to a factory, and patrons were expected to be located within a mile or two, and 4 or 5 miles was the maximum haul. Larger factories were soon favored as more economical, and very large ones have been lately put in operation, each receiving the daily product of thousands of cows. Milk and cream is hauled twice as far as formerly to patronize a factory, and often by cooperation among the farmers along a "route." All patrons are now expected to cool their milk thoroughly before it leaves the farm. In the latest form of creamery management, cream is collected over many square miles of territory and transported long distances by rail to be made into butter at a central factory. (A modern creamery is shown in Pl. V.)

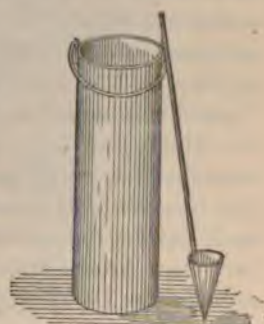


FIG. 4.—"Shotgun" setting can and cream dipper.

THE CONDENSED-MILK INDUSTRY.

The condensed-milk industry had its beginning coincident with the inauguration of the factory system for making butter and cheese. Some method of preserving milk had long been sought and numerous

preparations of the article had been offered, but these failed to meet the requirements and win public favor. In 1846 experiments were begun in New York by Mr. Gail Borden with a view of securing a preserved milk that was pure, wholesome, and palatable, capable of being transported long distances and kept for long periods in trying climates, and then serving as a satisfactory substitute for crude, fresh milk; but it was not until 1856 that he obtained results which have since popularized the product in every quarter of the globe. The previously prevailing ideas of a dry form of milk (desiccated, solidified, or powdered) were abandoned, and it was decided that a semiliquid state was the best form for preservation. The correctness of this decision is attested by the fact that, extensive as the industry now is and numerous as are the commercial brands, all condensed milk is still prepared under substantially the system then originated. This applies to the unsweetened as well as to the sweetened article, for "plain condensed milk" was first introduced and put upon the market about the year 1861. It was then mainly in open vessels and intended for early use. At that time condensed milk in both forms had become well known, and four or five factories were in operation, each producing about 5,000 one-pound cans per day. For the year 1879 the production of condensed milk in the United States was reported as 13,000,000 pounds and for 1889 as 38,000,000 pounds.

APPLICATION OF MECHANICS TO THE DAIRY.

The third quarter of the century was also a period of unprecedented progress in the application of mechanics to the dairy. The factories

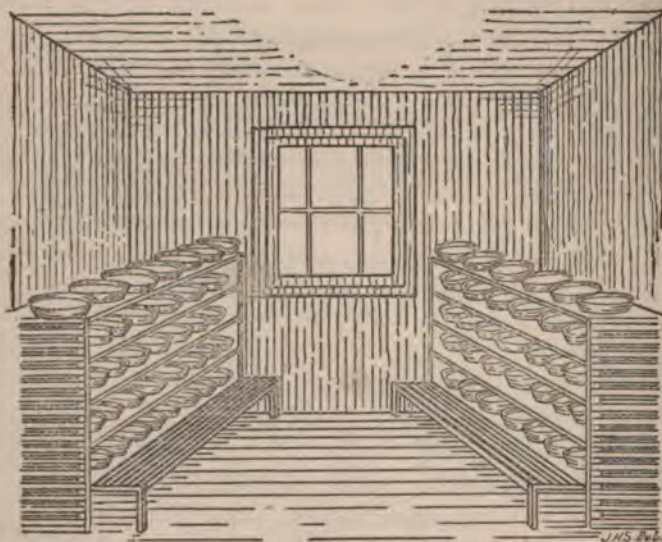


FIG. 5.—Milk room, with small shallow pans.

and creameries required new equipment, adapted to manufacture upon an enlarged scale, and equal attention was paid to the improvement

of appliances for farm dairies. Shallow pans were changed in shape and greatly enlarged; some were made to hold 20 or 30 gallons and had bottom and sides double for cooling or warming by the water jacket. (See figs. 5 and 6). Then these big pans, and most others, disappeared in favor of deep setting. This system, in which deep

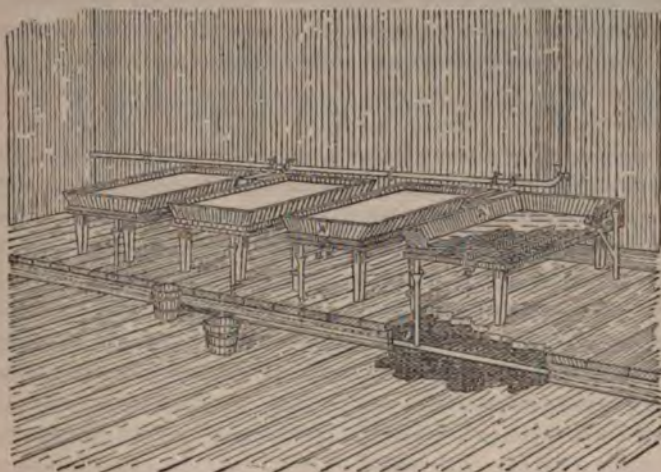


FIG. 6.—Large milk pans, open and shallow.

cans were used, set in cold water, preferably iced water, was introduced from Sweden, although the same principles had been in practice for generations in the spring houses of the South. Numerous creaming appliances, or creamers, were invented, based upon this

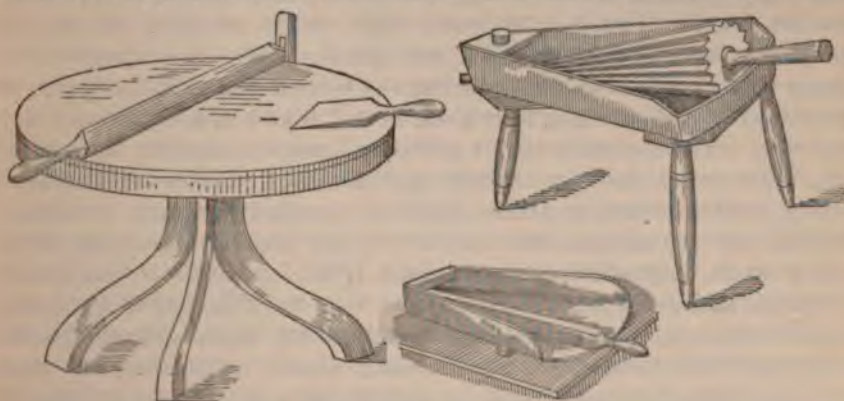


FIG. 7.—Patterns of hand butter workers.

system. Butter workers of various models, most of them employing the lever, or a crank and roller, took the place of the bowl and ladle and the use of the bare hand. Churns appeared of all shapes, sizes, and kinds, the general plan being to abolish dashers and substitute the agitation of cream for violent beating. About this time the writer

made a search of the United States Patent Office records, which revealed the fact that forty or fifty new or improved churns were claimed annually, and, after about one-fourth were rejected, the patents actually issued provided a new churn every ten or twelve days for more than seventy years! This illustrates the activity of invention in the dairy line. It was admitted by all that at this period the United States was far in advance of any other country in the variety and excellence of its mechanical aids to dairying. (Fig. 7.)

ORGANIZATION OF DAIRYMEN'S ASSOCIATIONS.

The same period witnessed the organization of dairymen in voluntary associations for mutual benefit, the formation of clubs and societies of breeders of pure-bred cattle, and the appearance of the first American dairy literature of consequence in book form. The American Dairymen's Association was organized in 1863. Its field of activity was east of Indiana, and accordingly the Northwestern Dairymen's Association was formed in 1867. Both of these associations continued in existence, holding periodical conventions and publishing their proceedings for twelve or fifteen years. Then followed the formation of State dairy associations in Vermont (1870), Pennsylvania (1871), Wisconsin (1872), Illinois (1874), Iowa (1876), New York (1877), and other States, superseding the few pioneer societies, which, for the time, covered broader fields.

INTRODUCTION OF DAIRY CATTLE AND EFFORTS AT HERD IMPROVEMENT.

The Shorthorn breed led in the introduction of improved cattle to the United States, and for a long time the representatives of this race, imported from England, embraced fine dairy animals. Shorthorn grades formed the foundation, and an excellent one, upon which many dairy herds were built during the second and third quarters of the century, and much of this blood is still found in prosperous dairy districts. The period named was that of greatest activity in importing improved cattle from abroad; but Shorthorns have been so generally bred for beef qualities that the demand for them is almost exclusively on that line, and very few of the breed are now classed as dairy cattle. Ayrshires from Scotland, Holstein-Friesians from North Holland, and Jerseys and Guernseys from the Channel Islands, are the breeds recognized as of dairy excellence, and upon animals graded and improved from these the industry mainly depends. The first two breeds named are noted for giving large quantities of milk of medium quality; the other two, both often miscalled "Alderney," give milk of exceeding richness, and theirs is the favorite blood with butter makers. There are also the Brown Swiss and Simmenthal cattle from Switzerland, the Normandy breed from France, and Red-Polled cattle from the south of England which have dairy merit, but belong rather to what is called the "general-purpose" class. Associations of

persons interested in maintaining the purity of the respective breeds have been formed since 1850, and they all record pedigrees and publish registers or herdbooks. Pure-bred herds of some of these different breeds are owned in nearly every State, and these animals aggregate 200,000 or 300,000. Their blood is so generally diffused that half-breeds or higher grades are very numerous wherever cows are kept for dairy purposes. Therefore, although pure-bred animals form less than 2 per cent of the working dairy herds, their influence is so great that it is probable the average dairy cow of the United States at the close of the century will carry nearly 50 per cent of improved blood. The breeding and quality of this average cow, and consequently her productiveness and profit, have thus been steadily advanced.

The progress made in this respect in fifty years has been remarkable. When improvement upon the native stock began, a cow that would make a pound of butter a day for two or three months was a local celebrity. Now and then a single animal made a really noteworthy record, like that of the Oakes cow, famous in Massachusetts about 1816. This cow gave 44 pounds of milk a day and made 467 pounds of butter during one season, but she was evidently a sport and failed to reproduce her equal. The first good record of definite herd improvement was made by Zadock Pratt, of Greene County, N. Y. By careful selection and culling he increased the average butter product of his 50 cows from 130 pounds for the year 1852 to 225 pounds in 1863; for seven years the average milk yield was 4,710 pounds per cow. About 1865, when good cows sold for \$40 or less, an enterprising dairyman in New England advertised widely that he would pay \$100 for any cow which would yield 50 pounds of milk a day on his farm for two or three consecutive days. Not an animal was offered under these conditions. The good dairy cow has now been so long bred to a special purpose that instead of the former short milking period, almost limited to the pasture season, it yields a comparatively even flow of milk during ten or eleven months in every twelve, and if desired the herd produces as much in winter as in summer. A cow that does not average 6 or 7 quarts of milk per day for three hundred days, being 4,000 to 4,500 pounds a year, is not considered profitable. There are many herds having an average yearly product of 5,000 pounds per cow, and single animals are numerous which give ten or twelve times their own weight in milk during a year. Quality has also been so improved that the milk of many a cow will make as much butter in a week as did that of three or four average cows of the mid-century. Whole herds average 300 to 350 pounds of butter a year, occasionally more, and authenticated records of cows giving 2 pounds a day are very numerous. Rivals to the Oakes cow may now be found frequently, often several in one bovine family, the dairy merit maintained and transmitted by judicious

breeding; and although animals of such excellence are none too common, they no longer excite astonishment or incredulity. (Pl. VI.)

DAIRYING DURING THE CLOSING DECADES OF THE CENTURY.

The development of dairying in the United States during the closing decades of the nineteenth century has been uninterrupted and marked by events of the greatest consequence in its entire history. The importance of two inventions during this period can not be overestimated.

MECHANICAL SEPARATION OF CREAM FROM MILK.

The first is the application of centrifugal force to the separation of cream from milk. This is based upon the fact that the specific gravity of milk serum, or skim milk, is greater than that of the fatty portion, or cream. The dairy centrifuge, or cream separator (fig. 8), enables the creaming or "skimming" to be done immediately after milking, prefer-

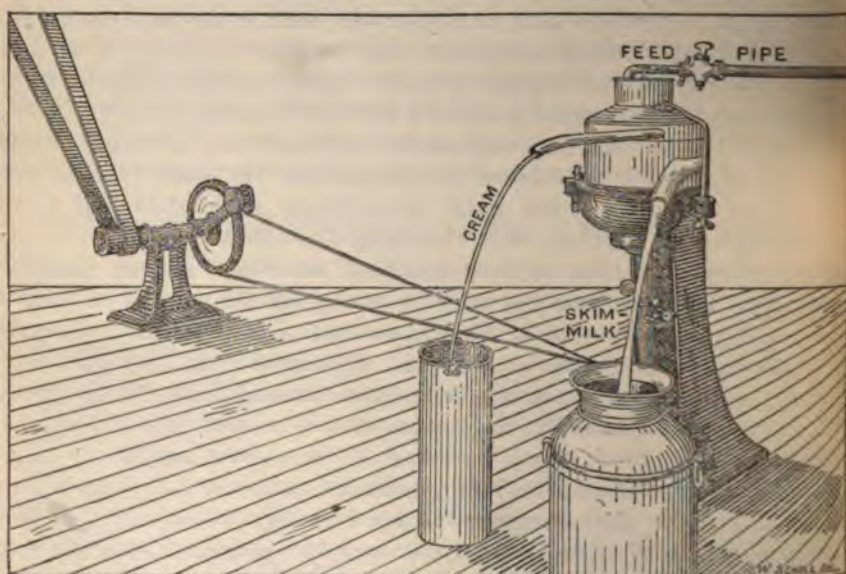


FIG. 8.—Centrifugal cream separator (in operation).

ably while the milk has its natural warmth. The cream can be churned at once, while sweet, but the better and usual practice is to cool thoroughly and then slowly cure, or "ripen," it for churning. The cream can be held at a comparatively high temperature, avoiding the necessity of much ice or cold water. The skim milk is available for use while still warm, quite sweet, and in its best condition for feeding to young animals. This mechanical method is more efficient than the old gravity system, securing more perfect separation and preventing loss of fat in the skim milk. It also largely reduces the dairy labor.



FIG. 1.—A PIONEER CREAMERY IN THE STATE OF SOUTH DAKOTA.



FIG. 2.—A MODERN CREAMERY IN THE STATE OF NEW YORK.

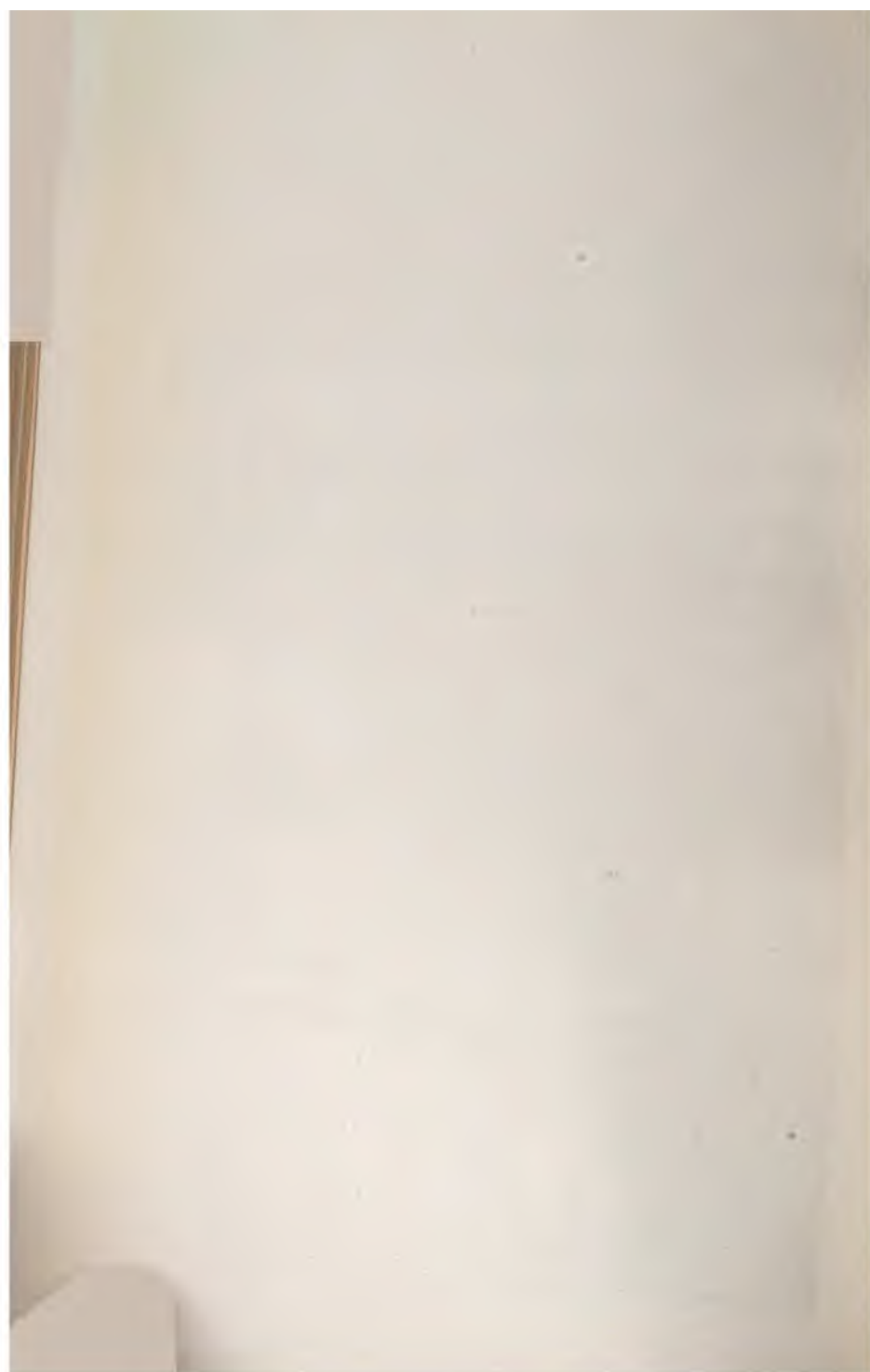




FIG. 1.—"THE OAKES COW."



FIG. 2.—DAIRY BULL, MODERN TYPE—GUERNSEY.



FIG. 3.—DAIRY COW, MODERN TYPE—JERSEY.



The handling and care of the milk may be thus wholly removed from the duties of the household. Separators are made of sizes and patterns suited to farm use, and to be operated by hand or power—a dog or a sheep, a bull or a horse, water, electricity, or steam. The foregoing conditions apply when the separation is done on the farm where the milk is produced. In creamery practice the milk is usually aired and cooled on the patrons' farms and hauled once a day to the factory; there it is warmed to facilitate the work, passed through the separator, and the skim milk may be at once hauled back to the farms. A creamery uses one or more separators of large capacity, operated by power. This practice involves the double haul and an apparent waste of the farmer's time and labor. A movement toward economy in this respect is the establishment of "skimming stations" at convenient points, equipped with one or more power separators; to these the milk is taken for separation from the farms in the vicinity, and from these stations the cream is carried to the central factory for curing and churning.

Besides its economy and its effect upon labor, the mechanical cream separator almost eliminates the factor of climate in a large part of dairy management, and altogether has worked a revolution in the industry. The centrifuge is still a marvel to those who see it working for the first time. The whole milk, naturally warm or warmed artificially, flows into a strong steel bowl held in an iron frame; the bowl revolves at rates varying from 1,500 to 25,000 times per minute, and from two projecting tubes the cream and skim milk separately flow in continuous streams. The machines can be regulated to produce cream of any desired quality or thickness. These separators of different sizes are capable of thus skimming or separating (more properly, creaming) from 15 to 500 gallons of milk per hour. A machine of standard factory size has a speed of 6,000 to 7,000 revolutions a minute and a capacity for creaming 250 gallons of milk an hour.

The world is indebted to Europe for this invention, at least as a dairy appliance. It is the only instance in which dairy invention abroad has been notably in advance of the United States. Yet, investigations were in progress contemporaneously in this country along the same line, and many of the material improvements in the cream separator and several novel patterns have since been invented here.



FIG. 9.—Babcock tester (cheap form, without bottles).

The machine has been vastly improved during its twenty years of existence. At first the bowl was filled with a "charge" of milk, the separation effected, the machine stopped, its compartments emptied of milk and cream, then refilled and started again. The continuously acting machine was soon invented, however, and is now universal.

Most of the power machines are still operated by pulley, belting, and intermediate (as shown in fig. 8), but in the latest patterns steam is applied directly to a turbine wheel in the base of the standard. The first centrifugal separators were put into practical use in this country and Great Britain in the year 1879. On the continent of Europe they were used a little earlier. The century closes with more than 40,000 of these machines in operation in the United States.

FAT TEST FOR MILK.

The second great dairy invention of the period is the popular fat test for milk, being a quick and easy substitute for chemical analysis. This is one of the public benefactions of the agricultural experiment stations. In several States these stations have done much creditable

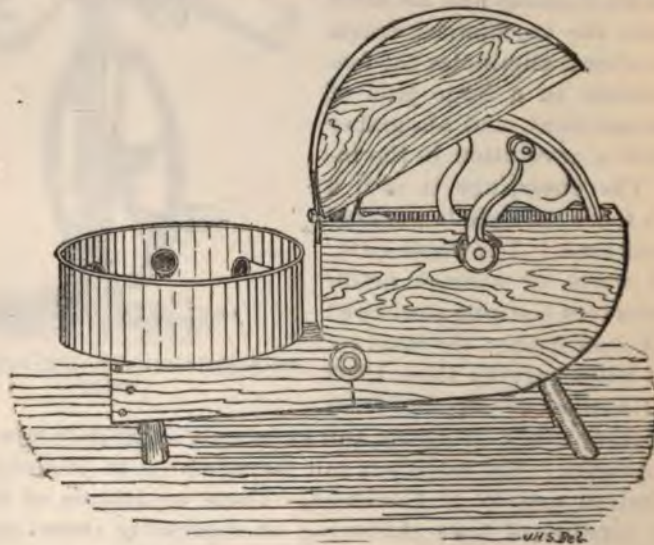


FIG. 10.—Early and cheap form of Babcock tester.

work in dairy investigation, and from them have come several clever methods for testing the fat content of milk. The one which has been generally approved and adopted in this and other lands is named for its originator, Dr. S. M. Babcock, chemist and dairy investigator, first of the New York experiment station at Geneva and since of the Wisconsin experiment station. (See figs. 9 to 13.) This test combines the principle of centrifugal force with simple chemical action. The machine on the Babcock plan has been made in a great variety of patterns, simple and inexpensive for home use and more elaborate and

substantial for factories. By these machines from two to forty samples may be tested at once in a few moments, and by the use of bottles specially provided the percentage of fat may be determined in samples of milk, cream, skim milk, or buttermilk. Of course, the glassware appurtenances of these testers must be mathematically accurate. Besides the machine and its fittings, the only supplies needed are sulphuric acid of standard strength and warm water. Any person of intelligence can soon learn to make ordinary tests with this appliance, but care and skill are necessary to absolutely correct results.

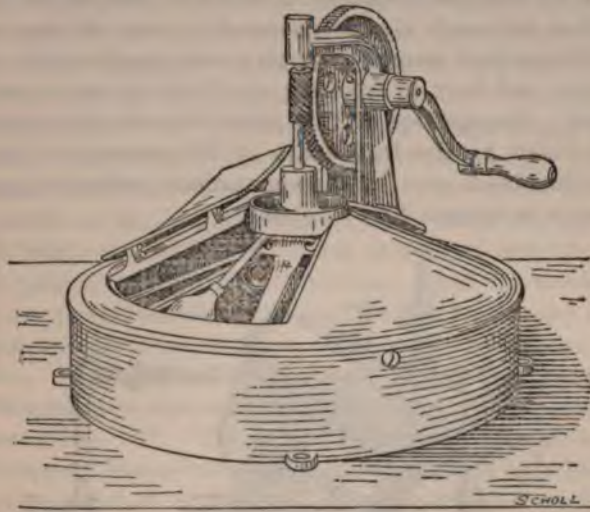


FIG. 11.—Hand Babcock tester, with strong drum.

This fat test of milk has wide application, and it may fairly be questioned whether it is second to the cream separator in advancing the economics of dairying. The percentage of fat being accepted as the measure of value for milk for nearly all purposes, the Babcock

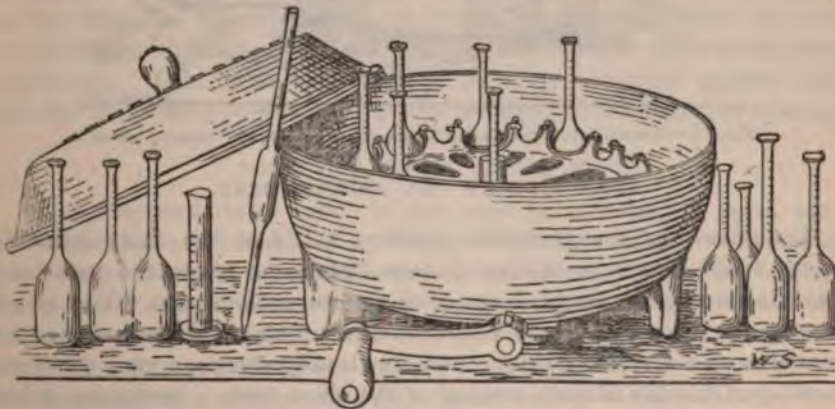


FIG. 12.—Hand Babcock tester, with variety of glassware.

test may be the basis for municipal milk inspection, for fixing the price of milk delivered to city dealers, to cheese factories, creameries, and condenseries, and for commercial settlements between patrons in cooperative dairying of any kind. By this test also the dairy farmer may prove the quality of milk from his different cows and (with quantity of milk yield recorded) may fix their respective value as dairy animals. Cows are now frequently bought and sold upon the basis of the milk scale and the Babcock test. With perfect apparatus in competent hands the accuracy of the test is beyond question, and it is of the highest scientific value and practical use. It should be noted that although clearly patentable, thus offering to the patentee an independent income through a very small royalty, this priceless invention and boon to dairying was freely given to the public by Dr. Babcock. Recognition of this public service has taken the form of a medal voted by the legislature of Wisconsin, and a handsome testimonial has been sent by the spontaneous action of appreciative creamery men in distant New Zealand.

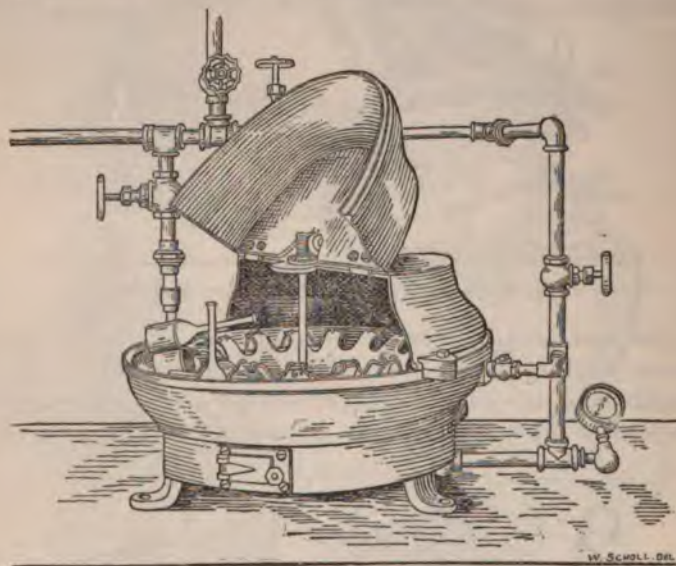


FIG. 13.—Babcock tester for use by direct steam power, or "turbine tester."

DAIRYING AT THE PRESENT TIME.

The advent of the twentieth century will find the dairy industry of the United States established upon a plane far above the crude and variable domestic art of three or four generations ago. The milch cow itself, upon which the whole business rests, is almost as much a machine as a natural product, and, as already shown, a very different creature from the average animal of the olden time. Instead of a few homely and inconvenient implements for use in the laborious duties

of the dairy, perfected appliances, skillfully devised to accomplish their object and lighten labor, are provided all along the way. Long rows of shining tin pans no longer adorn rural dooryards. The factory system of cooperative or concentrated manufacture has so far taken the place of home dairying that in entire States the cheese vat or press is as rare as the handloom, and in many counties it is as hard to find a farm churn as a spinning wheel.

A SAMPLE OF THE CHANGES IN DAIRY PRACTICES.

Here is an example of the radical change wrought in dairy practices: Northern Vermont has long been a region of large butter production. St. Albans is the business center of Franklin County. During the middle of the century the country-made butter from miles around came to this market every Tuesday. The average weekly supply was 30 to 40 tons. This butter was very varied in quality, was sampled and classified with much labor and expense, placed in three grades, and forwarded to the Boston market, 200 miles distant. During twenty-five years ending in 1875, some 65,000,000 pounds, valued at \$20,000,000, passed through this little town. All of this was dairy butter made upon one or two thousand different farms, in as many churns. In 1880 the first creamery was built in this county; ten years later there were fifteen. Now, a creamery company located at St. Albans has fifty-odd skimming or separating stations distributed through this and adjoining counties. (Pl. VII.) To those is carried the milk from more than 30,000 cows. Farmers having home separators may deliver cream which, being inspected and tested, is accepted and credited at its actual butter value, just as other raw material is sold to mills and factories. The separated cream is conveyed by rail and wagon—largely the former—to the central factory. There, in one room, from 10 to 12 tons of butter are made every working-day. A single churning place for a whole county! All of this butter is of standard quality, "extra creamery," and is sold on its reputation, upon orders from different points received in advance of its manufacture. The price is relatively higher than the average for the product of the same farms fifty years ago. This is mainly because of better average quality and greater uniformity—two important advantages of the creamery system.

METHOD OF MILKING UNCHANGED.

In one respect dairy labor is the same as a hundred years ago. Cows still have to be milked by hand. Although numerous attempts have been made, and patent after patent has been issued, no mechanical contrivance has yet been a practical success as a substitute for the human hand in milking. Therefore, twice a day, every day in the year, the dairy cows must be milked by manual labor. This is one of the main items of labor in dairying, as well as a most delicate and important duty. Allowing 10 cows per hour to a milker, which means

lively work, it requires the continuous service of an army of 300,000 men, working ten or twelve hours a day throughout the year, to milk the cows kept in the United States.

ORGANIZATION OF THE DAIRY INDUSTRY.

The industry is becoming thoroughly organized. Besides local clubs, societies, and unions, there are dairy associations in thirty States, most of them incorporated, and receiving financial aid under State laws. The proceedings of the annual conventions are, in several instances, reported and published at public expense. In some States the butter makers and cheese makers are separately organized; in some States creamery men and dairy farmers hold separate meetings. Large competitive exhibits of dairy products are also held, and Pl. VIII shows the annual exhibit for 1899 of the National Creamery Butter Makers at Sioux Falls, S. Dak., including the exhibit of foreign butters by the Department of Agriculture. Eighteen States provide by law for officials known as dairy commissioners or food and dairy commissioners. These officers have a national association, and there are also two national organizations of dairymen. At several large cities and centers of activity in the commerce of the dairy there are special boards of trade. The Department of Agriculture has a Dairy Division, whose purpose is to keep informed upon and to promote the dairy interests of the country at large. Dairy schools are maintained in a number of States, offering special courses of practical and scientific instruction in all branches of the business. (Pl. IX.) These schools and the agricultural experiment stations, with which most of the dairy schools are connected, are doing much original research, and constantly adding to the store of useful information as to the application of modern science to this industry. Graduates from the schools are scattered all over the country as managers of dairy farms and superintendents of creameries and cheese factories, and are contributing to the general improvement in dairy methods and results. Weekly and monthly journals in the interest of dairy production and trade are published in various parts of the country, and during the last decade or two a number of noteworthy books on different aspects of dairying have been published, so that the student of this subject may fill a good-sized case with substantial volumes, technical and practical in character.

MILK PRODUCTION.

The business of producing milk for town and city supply, with the accompanying agencies for transportation and distribution, has grown to immense proportions. In many places the milk trade is regulated and supervised by excellent municipal ordinances, which have done much to prevent adulteration and improve the average quality of the supply. Full as much, however, is being done by private enterprise,



FIG. 1.—SKIMMING STATION AT A VERMONT CREAMERY.



FIG. 2.—FRANKLIN COUNTY CREAMERY, ST. ALBANS, VT.





FIG. 1.—EXHIBIT OF FOREIGN BUTTERS BY THE UNITED STATES DEPARTMENT OF AGRICULTURE 1899.



FIG. 2.—NATIONAL CREAMERY BUTTER MAKERS' ANNUAL COMPETITION, SIOUX FALLS, S. DAK., JANUARY, 1899.





FIG. 1.—IOWA DAIRY SCHOOL AND COLLEGE CREAMERY AT AMES.



FIG. 2.—WISCONSIN DAIRY SCHOOL AT MADISON—MILK TESTING.





FIG. 1.—DAIRY BARN FOR 250 COWS IN NEW JERSEY.



FIG. 2.—MILKERS READY FOR WORK AT LARGE DAIRY FARM IN NEW JERSEY.





FIG. 1.—COOLING AND BOTTLING ROOM ON A DAIRY FARM IN PENNSYLVANIA.



FIG. 2.—BOTTLING ROOM ON A DAIRY FARM IN NEW YORK.

through large milk companies, well organized and equipped, and establishments which make a specialty of serving milk and cream of fixed quality and exceptional purity. These efforts to furnish "certified" and "guaranteed" milk and general competition for the best class of trade are doing more to raise the standard of quality and improve the service than all the legal measures. The buildings and equipment of some of these modern dairies are quite beyond precedent. This branch of dairying is advancing fast, and upon the substantial basis of care, cleanliness, and better sanitary conditions. (Pls. X and XI.)

CHEESE MAKING.

Cheese making has been transferred bodily from the realm of domestic arts to that of manufactures. Farm-made cheeses are hard to find anywhere; they are used only locally, and make no impression upon the markets. In the middle of the century about 100,000,000 pounds of cheese was made yearly in the United States, and all of it in farm dairies. At the close of the century the annual production of the country will be about 300,000,000 pounds, and 96 or 97 per cent of this will be made in factories. Of these establishments, there are nearly 3,000, but they vary greatly in capacity, and many are very small. New York and Wisconsin each has a thousand. The former State makes nearly twice as much cheese as the latter, and the two together produce three-fourths of the entire output of the country. The other cheese-making States, in the order of quantity produced, are Ohio, Illinois, Michigan, and Pennsylvania; but these are all comparatively unimportant. A change observed as taking place in the factory system is that of bringing a number of factories previously independent into a "combination" or under the same management. This tends to improve the quality and secure greater uniformity in the product, and often reduces cost of manufacture, all being decided advantages. More than nine-tenths of all cheese made is of the familiar standard variety, copied after the English Cheddar, but new kinds and imitations of foreign varieties are increasing. The cheese made in the country, with the small importations added, gives a yearly allowance of less than 4 pounds to every person; but as 30,000,000 to 50,000,000 pounds are still annually exported, the per capita consumption of cheese in the United States does not exceed $3\frac{1}{2}$ pounds per annum. This is a very low rate, much less than in most European countries.

BUTTER MAKING.

Great as the growth of the associated system of butter making has been and fast as creameries have multiplied, especially in the newer and growing agricultural States, such as Minnesota, Nebraska, Kansas, South Dakota, and Washington, there is still much more butter made on farms in the United States than in creameries. Creamery butter controls all the large markets, the dairy products making comparatively little impression on the trade; but home consumption and the supply of small customers and local markets make an immense

aggregate, being fully two-thirds of all. Estimating the annual butter product of the country at 1,400,000,000 pounds, not much over 400,000,000 of this is made in the 7,500 or 8,000 creameries now in operation. Iowa is the greatest butter-producing State and the one in which the greater proportion is made on the factory plan. This State has 780 creameries, only two counties being without them; about two-fifths are cooperative. In these creameries about 88,000,000 pounds of butter are yearly made from 624,000 cows. It is estimated that in the same State 50,000,000 pounds of butter in addition are made in farm dairies. The total butter product of this State is therefore one-tenth of all made in the Union. Iowa sends over 80,000,000 pounds of butter every year into other States. New York is next in importance as a butter-making State, and then come, in order, Pennsylvania, Illinois, Wisconsin, Minnesota, Ohio, and Kansas. Yet, all of these combined make but little more than one-half of the annual butter crop of the United States, and in no one of them except Iowa is half of the butter produced made in creameries. The average quality of butter in America has materially improved since the introduction of the creamery system and the use of modern appliances, and the average continues to improve. Nevertheless, a vast quantity of poor butter is made—enough to make a large and profitable business in collecting it at country stores at grease prices or a little better and rendering or renovating it by patent processes. This renovated butter has been fraudulently sold to a considerable extent as the true creamery article, of which it is a fair imitation while fresh, and several States have recently made laws to identify the product and prevent buyers from being deceived. No butter is imported into this country, and the quantity exported is as yet insignificant, although there is beginning to be a foreign demand for American butter. The home consumption must accordingly be at the yearly rate of 20 pounds to the person, or about 100 pounds annually to the family of average size. If approximately correct, this shows Americans to be the greatest butter-eating people in the world.

The people of this country also consume millions of pounds every year of butter substitutes and imitations, such as oleomargarine and butterine. Most of this is believed to be butter by those who use it, and the State dairy commissioners mentioned are largely occupied in the execution of laws intended to protect consumers from these butter frauds.

BY-PRODUCTS OF DAIRYING.

Within recent years there has been great development in the economical uses of the by-products of dairying. Ten years ago there were enormous quantities of skim milk and buttermilk from the creameries and of whey from cheese factories, which were absolutely wasted. At farm dairies these by-products are generally used to advantage in feeding animals, but at the factories, especially at

the seasons of greatest milk supply, this most desirable method of utilization is largely impracticable. In many places new branches have lately been added to the industry, which make sugar of milk and some other commercial products from whey, and utilize skim milk in various ways. The albumen of the latter is extracted for use with food products and in the arts. The casein is desiccated and prepared as a baking supply and substitute for eggs, as the basis of an enamel paint, as a substitute for glue in paper sizing, and it is also solidified so as to make excellent buttons, combs, brush backs, handles, electrical insulators, and similar articles.

NUMBER OF COWS AND QUANTITY AND VALUE OF DAIRY PRODUCTS.

The cows in the United States were not counted until 1840, but have been since enumerated for every decennial census. It has required from 23 to 27 cows to every 100 of the population to keep the country supplied with milk, butter, and cheese, and provide for the export of dairy products. The export trade has fluctuated much, but has never exceeded the produce of 500,000 cows. With the closing years of the century it is estimated that there is one milch cow in the United States for every four persons. This makes the total number of cows about 17,500,000. They are unevenly distributed over the country, being largely concentrated in the great dairy States. Thus, Iowa leads with 1,500,000 cows, followed by New York with almost as many; then Illinois and Pennsylvania, with about 1,000,000 each. The States having over 500,000 each are Wisconsin, Ohio, Kansas, Missouri, Minnesota, Nebraska, and Indiana. Texas is credited with 700,000 cows, but very few of them are dairy animals. In the Middle and Eastern States the milk product goes very largely to the supply of the numerous large towns and cities. In the central West and Northwest butter is the principal dairy product. The following table gives approximately an exhibit of the quantity and value of the dairy products of the United States in the year 1899:

Estimated number of cows and quantity and value of dairy products.

Cows.	Product.	Rate of product per cow.	Total product.	Rate of value.	Total value.
11,000,000	Butter	130 pounds	1,430,000,000 pounds.	18 cents ..	\$257,400,000
1,000,000	Cheese	300 pounds	300,000,000 pounds.	9 cents ..	27,000,000
5,500,000	Milk	380 gallons	2,090,000,000 gallons.	8 cents ..	167,200,000

This gives the grand total of the dairy products of the country a value of \$451,600,000. If to this be added the skim milk, butter-milk, and whey, at their proper feeding value, and the calves dropped yearly, the annual aggregate value of the produce of the dairy cows exceeds \$500,000,000. Accepting these estimates as conservative, they show that the commercial importance of the dairying of the United States is such as to command attention and justify all reasonable provisions for guarding its interests.

NOTES UPON DAIRYING IN CALIFORNIA AND EXPORT OF CALIFORNIA BUTTER TO THE ORIENT

By R. A. PEARSON, M. S.,

Assistant Chief of Dairy Division, Bureau of Animal Industry.

THE STATE FAIR.

The California State fair at Sacramento, September 4 to 16, 1899, said to be the most successful ever held by the State board of agriculture. The number of exhibits was larger than in previous years, the number of visitors had never been equaled. Although the dairy features of the fair were overshadowed by the exhibits of fruits and vegetables, which were shown in great number and variety, and by usual displays of agricultural products and implements, a very creditable showing was made of dairy stock, implements, and products.

DAIRY LIVE STOCK.

In the live-stock department were representatives of the leading milk breeds of the State—Jerseys, Holsteins, and Shorthorns—not a few of the animals showed high merit, capable of taking prize in many Eastern fairs. The exhibit demonstrated that at least some of the breeders of the State are well to the front in their work. There were fewer animals shown than would have been expected from a large State. One reason for this was the small number of registered herds in California as compared with other dairy States, another was the lack of sufficient interest on the part of owners of well-bred stock. There are numerous herds of blooded dairy cattle throughout the State; but it appears that the benefits of showing at the fair are not considered equal to the drawbacks, one of the greatest of which is the long and expensive haul to and from the fair. Without strong inducement, a breeder of fine cattle will not subject his animals to the excitement of travel and noisy crowds.

DAIRY MACHINERY.

The displays of creamery and dairy machinery and utensils were quite similar to what would be seen at a large Eastern fair; in fact, much of this apparatus is furnished to California supply houses from Eastern factories. On an elevated platform the operations of a working creamery were carried on daily. This instructive feature is commendable and worthy of imitation. The time and place of such an exhibition should be thoroughly advertised, so that all who might want to see it would know about it.

¹ This article is also published as Bulletin No. 24 of the Bureau.

BUTTER.

About thirty samples of butter—in squares, rolls, tubs, and small export packages—were entered for prizes. It was in three classes—fresh, June storage, and packed for export. Six prizes—\$30, \$25, \$20, \$15, \$10, and \$5—were offered in each of the first two classes, and three prizes—\$25, \$20, and \$15—were offered for export butter. Although these prizes did not attract an exceptionally large number of entries, the competing samples were representative of all sections of the State and they were uniformly of high quality. The butter was judged by Mr. W. D. McArthur, of San Francisco, a temporary special agent of this division, and the writer. The following table gives the names of exhibitors, their addresses, and scores. In order to show the districts where the exhibited samples were produced, the the State is divided into five parts of about equal size by imaginary east-and-west lines; these are designated from north to south by the letters A, B, C, D, and E, respectively, and the letters are shown in the first column of the table:

Scores on butter at the California State fair, September 13, 1899.

Exhibitors.	Section.	Flavor (50).	Grain (25).	Color (10).	Salt (10).	Appearance (5).	Total (100).
FRESH.							
Alton Creamery Co., Alton.....	A	47½	23½	10	10	5	96½
Eel River Creamery Co., Ferndale.....	A	47½	23½	10	10	5	96½
Geo. E. Peoples, Bakersfield.....	D	47½	23½	10	10	5	96
O. J. Vine, Lakeport.....	B	47½	23	10	10	5	93½
G. G. Knox, Grafton.....	B	47½	23	9½	10	5	93½
Allen Quain, Stockton.....	C	47½	23	10	10	5	95½
Joseph Sheppard, Point Arena..	B	47½	22½	10	10	5	95
O. E. Jones, Newman.....	C	47½	22½	10	10	5	95
Lockeford Creamery Co., Lockeford.....	C	47	22½	10	10	5	94½
J. N. Keiser, Hollister.....	C	46½	22½	9½	10	5	93½
J. A. Howie, Compton.....	E	46	22½	10	10	5	93½
Warren Myers, Woodland.....	B	45	23	10	10	5	93
C. A. Starkweather, Oakdale.....	C	46½	22	10	9½	5	93½
W. T. Mitchell, Susanville.....	A	46½	22½	9	10	5	93½
Geo. E. Newman, Lompoc.....	E	45	22½	10	9½	5	92½
JUNE STORAGE.							
W. M. Twiner, Sierra Valley.....	B	45	23	10	10	5	93
E. H. Zimmerman, Watsonville..	C	44½	22½	10	10	5	92½
J. H. Keiser, Hollister.....	C	44	23	10	10	5	92
D. Brough, Newman.....	C	44	22½	9½	10	5	91½
A. J. Bloom, Petaluma.....	B	44	22	10	10	5	91
Bailey Bros., Crescent City.....	A	43	22½	10	10	5	90½
W. T. Mitchell, Susanville.....	A	42½	22½	10	10	5	90
O. J. Vine, Lakeport.....	B	42	23	10	10	5	90
O. E. Jones, Newman.....	C	42½	22½	9½	10	5	89½
C. A. Starkweather, Oakdale.....	C	42	23	10	10	4½	89½

Butter in small cans for export.

[Cans scored equally; judged on quality of butter.]

Dairymen's Union of California, San Francisco, first premium for butter in paraffined paper can; Hilmer, Bredhof & Schulz, San Francisco, second premium for butter in lithographed tin can; Sussman, Wormser & Co., San Francisco, third premium for butter in lithographed tin can.

Both first and second prizes on fresh-made butter went to creameries in Humboldt County, a large county near the northern boundary of the State, bordering on the ocean, and possessing exceptional advantages for dairying. Some well-informed dairymen claim that this county is the best natural dairy district in the world. The third prize on fresh-made butter was taken by a creamery in the southern part of the State. The fourth and fifth prizes went to the district just north of an east-and-west line through San Francisco, and the sixth prize to the district just south of the same line. All of the entries of storage butter were from the central and northern parts of the State.

It happened that the Humboldt County creameries had a distinct advantage over most of the others in the State at the time the fresh butter was made for the fair, as many factories elsewhere were then receiving milk from patrons whose pastures were suffering on account of the dry season, and undesirable flavors could not be avoided, while the pastures in Humboldt were in good condition. The aroma and flavor of the Humboldt County butter were excellent. It was also exceptionally well made and well packed, as was shown by the fact that it stood the three days' journey by boat and rail from the creameries to Sacramento without unusual protection. It was in the regular California squares, described on page 282. Other entries were in small tubs.

Butter in hermetically sealed pound packages for export was exhibited in small quantity. The judges deemed it best not to attempt to decide the merits of the different packages, as the experimental shipments of butter from the Pacific coast to trans-Pacific ports, now being made by the United States Department of Agriculture, are partly for the purpose of testing the several packages available for shipments without refrigeration to tropical points. Therefore in this class prizes were awarded on the basis of the quality of the butter in the cans; and in this respect there was considerable variation, some of the samples being decidedly rancid. These small cans had been exposed for several days to high temperatures. Possibly they were thus put through more unfavorable conditions than would be encountered on a voyage to the Tropics, but this was probably not the case. They again showed that hermetically sealed cans will not, under all circumstances, preserve the good qualities of butter, as some people seem to think they are capable of doing.



FIG. 1.—A CALIFORNIA DAIRY HERD.



FIG. 2.—COMBINED DAIRY AND SUGAR-BEET RANCH.

THE DAIRYMEN'S ASSOCIATION.

The sixth annual meeting of the California State Dairymen's Association was held during the State fair at the capitol building. It was attended by leading dairymen, creamery men, and cheese factory men from all parts of the State. Representatives were present from commission houses in San Francisco and Sacramento. The State University was well represented, and the sessions were visited by prominent citizens. The press of the State gave liberally of its space in reporting the proceedings. A regular programme had not been prepared, as it was thought best to occupy the time with informal discussions on the special subject which the secretary had announced in advance, namely, "The export of dairy products from the Pacific coast." The topic was opportune, and its various phases were taken up and discussed in a logical way. A brief résumé of the facts brought out in the discussion follows.

THE INCREASE OF BUTTER PRODUCTION.

First, it was pointed out that dairying in the older States is being promoted and encouraged by various agencies, such as well-equipped dairy schools, live dairy associations, and efficient State dairy commissioners. And it is now being extensively developed as a new industry in certain large sections of the United States where only a few years ago cows were seldom seen. As examples of this recent dairy growth the activities in Georgia and the Dakotas were referred to. All this shows that our home markets will continually be more and more plentifully supplied, and in many cases competition will be keen.

It was stated that the production of dairy products in California is increasing, and in some sections very rapidly. This is not surprising when one considers how the industry is favored by many natural conditions, of which too much could hardly be said. The mild climate, splendid natural grazing, and the tremendous crops of alfalfa which can be raised at small cost almost make it seem that California has been favored above all other States. Many of the great wheat ranches are gradually adopting dairying as a secondary interest, and some of them have gone into it further than they had originally planned. Large herds of dairy cows (Pl. XII, fig. 1) are becoming common, and the owners of less than one hundred cows refer to their "small herds" very much as an Eastern dairyman would speak of his fifteen or twenty cows. New creameries are in operation at many points. Besides the advantages named, the markets for dairy products have been good. It has been possible for the California dairyman to produce cheaply and sell well. It is therefore not unlikely that the growth of dairying will continue, and within a few years more butter and cheese will be made than the home market will require. California dairymen will then face conditions similar to those already met in the Eastern markets.

FOREIGN MARKETS FOR SURPLUS.

In the second place, the possibilities of finding markets for surplus in countries bordering on the Pacific Ocean were discussed. Although some of those lands fairly swarm with people, only small quantities of dairy products are sent to them, and these supplies are chiefly for the few foreigners who are there—Americans, English, Germans, and French. As a rule the natives have not yet learned to use butter and cheese, but extracts from consular reports were read which showed that in some cases they are commencing to eat dairy products and a gradual increase in their demands may be expected. With improvement of domestic and commercial conditions, new tastes are developed and new wants are manifested. This is shown in the upward growth of every nation. Just at this time the changes which are taking place in some Asiatic countries are attracting the attention of the world. Every commercial nation is looking for new trade in articles not before called for, and in this respect California merchants propose to take an important place. American flour is a product which has successfully established a market for itself within the past few years. Large quantities are now shipped to places where it was once prophesied flour would never be commonly used. Other illustrations could be given of American products which have found favor. Judging by the success along other lines and by the small beginning already made by our butter and cheese, the Western dairymen have good reason to feel encouraged in their hopes of finding large markets across the Pacific. And it may be profitable to have such an abundant surplus that regular and frequent shipments can be made, at least during the season of greatest production, at which time there will be but little competition from dairy countries south of the equator.

Furthermore, attention was called to the fact that most of the small amount of butter going to the points referred to is now supplied by Denmark, France, and Australia, and, as a rule, the products from those countries are sold at prices in excess of what is paid for "States goods." In other words, the present limited demand for dairy products in the far East is being supplied chiefly by our competitors, and they frequently receive as high as 50 cents per pound for their butter. The California dairymen should, and many of them do, appreciate that the best way to assure themselves of enjoying a large share of the future trade with the Pacific countries is to secure and hold a large share of the present trade with those countries.

PREPARATION OF BUTTER FOR WARM CLIMATES.

It having been shown that there may soon be a surplus of dairy products available for export, that in the near future large markets for these products may be developed at trans-Pacific points, and especially that the United States does not share in the present trade to the extent that she should, the next question considered was how

butter should be prepared for shipment to warm climates. There was an interesting discussion on the various phases of this question, participated in by dairymen, creamery men, and scientists, and numerous ideas of practical value were advanced. The want of refrigerated compartments for ocean transportation makes the problem quite different from what it is in the East.

As to the kind of butter wanted, all agreed that for export without refrigeration it should be of particularly hard body and high melting point. More stress was laid on this than on the necessity of its having a high flavor. A clean, mild flavor is wanted, and an article of close texture, with a dry, solid body and capable of resisting the effect of heat as much as may be. At the same time producers were warned not to make such butter except for foreign trade, as it would not sell so well as the regular creamery in home markets.

Causes affecting hardness of butter.—It is believed that the body, or hardness, of butter is largely within control of the feeder and butter maker. It is thought by some that butter made from milk containing large fat globules has a lower melting point than that made from milk containing small fat globules. According to this theory, butter from Channel Island stock would be softer than that from the so-called "cheese" breeds, a proposition that was opposed by not a few. It was stated, also, that butter made from milk taken during the latter part of the period of lactation is harder than that from milk taken soon after calving. That the body of butter can be easily affected by variations in manufacture is well known.

An important cause of difference in hardness is supposed to be difference in the relative proportions of the component parts of the butter fat caused by various kinds of feed. An increase in the stearin and palmitin, which are solids at ordinary temperatures, and a corresponding decrease in olein, which is an oil at ordinary temperatures, would cause butter to be harder, while changes of an opposite nature would make it softer. Practical experience and a few experiments show that the hardness of butter can be affected to a certain extent by the feeds given the cows. It was generally agreed that butter is made hard by the addition to the ration of a small amount of potatoes; cotton-seed meal has a similar effect, but too much of it will taint the butter. One person said oat hay and green corn fodder also have somewhat the same effect. On the other hand, linseed meal causes soft butter, and alfalfa hay when used alone does the same. An instance was given of a herd which had been fed on alfalfa and Bermuda grass and was changed to a pasture of young barley that had dried up before it was fully grown. The butter immediately became very hard. A commission merchant reported that the butter from one of his shippers suddenly became hard and would not melt as readily as usual. Upon investigation it was found that the herd had recently been turned onto a stubble field. Sugar-beet pulp and tops were not discussed, but some facts about them are given below.

Method of making.—No special points were brought out regarding the manufacture of butter for the new trade. The ordinary methods are followed, but the necessity of using great care in every step of the work, so as to produce the highest grade article, was emphasized. The butter maker should discard all dirty milk. He can not afford to introduce into the butter millions of bacteria of many species, which may cause bad flavors, when they can easily be excluded. It was recommended both to wash and to work the butter a little more than usual, to get out as much as possible of the casein, albumen, and sugar, which are excellent materials for bacteria to feed upon. Even when all possible precautions have been taken there will still be many bacteria in the finished product. Coloring and salting need not be different from the home requirements, unless to comply with special orders. It is the practice to do the canning in the butter cellars at San Francisco, using any butter sent to that market that appears to be satisfactory. The butter can be cut from large packages in lumps of proper size for the cans, so that reworking it is not necessary. Probably this method will obtain until a regular export trade is developed which will make it more economical to install canning appliances in the creameries.

The packages should be as nearly sterile as practicable at the time they are filled. They may be easily sterilized by exposure to steam in a tight chest of wood or galvanized iron. In packing, care should be taken to exclude the air as much as possible by having the butter completely fill the can. This is for the double purpose of keeping out bacteria which might be floating on dust particles in the air and to avoid furnishing one of the essentials for growth to those bacteria in the butter which can not develop without air. After the can is sealed some change takes place, unless it is held in cold storage, and this does not seem strange when it is remembered that, in spite of all the care which may be taken, some air will be in the cans and the butter is very likely to contain some bacteria which can thrive even in the absence of air. Thus it is seen that although hermetically sealed packages have many advantages they are not a panacea. The problem is not yet satisfactorily solved.

Preservatives.—There is a disposition on the part of some to use preservatives to hold bacteria in check, and various compounds of this class are on the market and are very strongly indorsed by those interested in their sale. Many misleading statements have been made in their favor. It has not been scientifically demonstrated whether preservatives in butter are harmful to consumers or not, but dairy scientists and leading dairymen strongly object to them on general grounds, and the laws of some States forbid their use. It is interesting to note that Danish butter, which holds the first place wherever it is sold, is free from preservatives, and it is almost unnecessary to add that no preservatives are or have been used in butter sent abroad.

by the United States Department of Agriculture. It is to be hoped that the California dairymen will not adopt them until an unquestioned authority has plainly shown that their advantages exceed their disadvantages. Their general use at this time might cause great injury to the fair reputation the State is seeking for its dairy products. A resolution condemning their use was adopted by the Dairymen's Association.

It is argued that in some respects the process of digestion is similar to fermentation, and that any substance which stops the usual changes in a food product will also affect its digestibility. Furthermore, some and perhaps all of the active chemical substances in preservatives have distinct influence on the functions of certain organs of the body. No one cares to take a dose of medicine without need of it, much less regular and frequent doses of an unknown substance, even though they are small, and many persons would prefer to go without a certain food than to run such a risk. Still another objection to preservatives is the fact that they make it impossible for the butter maker to control the cream ripening and the development of desired flavors. As a matter of fact, the effect of preservatives could be made unnecessary in most cases where they are used. A few milk producers and butter makers have unfortunately learned that these substances are, so far as appearances go, a fair substitute for cleanliness. By improving their methods they could do away with the use of the questionable compounds and enjoy a clear conscience in delivering to their customers goods known beyond a doubt to be pure. Preservatives do not wholly stop bacteria from growing and multiplying, and it is safe to say that by observing scrupulous cleanliness pure butter could be made which would keep as well as or better than the ordinary kind preserved. The pasteurization of milk for making butter for export is practicable, and it may be that this, in connection with cleanliness, will be the true solution of the problem.

Packages.—A round tin can holding 1 pound is the favorite package. Until quite recently all the joints of the can have been closed with solder, but now a special machine is used for fastening the top without solder, thus doing away with the necessity of applying heat to the can after it is filled. It is important to have the cans made of a good quality of standard tin (tin weighing about 100 pounds to the box has given satisfaction), and special care should be used to have them smoothly finished. The inside of the can is usually paraffined or lined with parchment paper; sometimes both paraffin and parchment paper are used.

The sale of butter always depends to a varying extent upon the appearance of the packages, and among the Oriental people appearance has a decided influence. They like neatness and decoration, and therefore it pays to finish the cans in a way that will please them. Seals, trade-marks, fancy figures, and lettering are recommended. Paper

labels soon become soiled, rubbed, and torn, and cans thus marked will be passed by for prettily lacquered ones. Some buyers attach more importance to the appearance of the packages than to the quality of their contents. There is no doubt that an official seal or stamp showing inspection by an authorized person would often serve as a guaranty and aid in sales. Cans opened by removing with a "key" a narrow strip of tin from the side near the top have an advantage over the old-fashioned style and are much preferred in some markets.

SOME PURPOSES OF THE DEPARTMENT'S EXPORTS.

During the discussions on the general subject of exports an account of the efforts of the Department of Agriculture to find and develop new markets for our dairy products was given. A letter from Maj. H. E. Alvord, Chief of the Dairy Division of the Bureau of Animal Industry, Department of Agriculture, was read and received with applause. It told of the experiments already made in exporting high-grade butter to the English market, and explained the purpose of the Department to conduct similar experiments from the Pacific coast, by sending small lots of selected butter and cheese to a half dozen of the largest seaport cities of Japan and China, to show that the best grades of dairy products can be procured in this country, and to obtain information as to the best ways of shipment. It was pointed out that while a temporary overproduction of butter or cheese can be easily cared for and kept off the market by our excellent storage facilities, a continued production of goods of high grade in excess of the home demand would result seriously to the dairy interests by causing a fall of prices, unless a profitable outlet could be found for the surplus. This fact commends to all dairymen any efforts to extend markets for milk products. Whether they are personally interested in exporting or not, their welfare may largely depend upon the success of those who are engaged in foreign trade.

It is most important for our butter and cheese to bear a good reputation in all foreign markets, so that they will be received at their true value at any time they are offered for sale, and this thought was plainly brought out by several speakers. Such a desirable condition does not now exist, owing partly to the fact that a large proportion of the dairy products sent out from this country is inferior in quality. This is well known to be the case with shipments from New York; it is also true of shipments from San Francisco. Some of the Western merchants argue that, as the butter will be somewhat off flavor anyway when it reaches its destination, it will make little difference if it is just a bit inferior when it starts! This mistake is largely responsible for the fact that our butter in cans sells in many places at prices 25 to 50 per cent lower than the goods from other countries.

Much interest was shown in the efforts of this Department to improve present conditions, and there were many liberal offers of

assistance. Especially was this generous spirit shown by some creameries that were willing practically to place themselves at our disposal for the preparation of goods for export. The possible needs of the Department were fully discussed with the officers of one well-equipped plant and they will hold themselves ready to fill any requirements on short notice.

THE PRESENT EXPORT TRADE.

A short time was spent in San Francisco arranging details in connection with our experimental exports. Although the three steamship lines to Hawaii, Japan, and China have more than they can do and are now refusing freight, their officials showed an interest in the work of the Department and agreed to assist in the experimental exports by carrying our consignments whenever offered. They do not have much call for service in refrigerated compartments, and nothing of this kind is provided.¹

By referring to the table below it will be seen that present shipments of dairy products would not justify transportation companies to go to very great expense for their exclusive accommodation. Nor is it now possible for this Department to guarantee to the steamship lines payment for freight on the full capacity of their refrigerators if not filled, as the Canadian government has practically done in some instances, to the great benefit of her dairy interests. The three principal trans-Pacific countries to which butter and cheese are sent from the United States are Japan, China, and Hongkong, and the amounts these countries and the Hawaiian Islands have received in recent years are shown in the following table. Of course, most of the shipments to these countries from the United States are from the Western ports:

Exports of butter and cheese from the United States to Japan, China, Hongkong, and Hawaiian Islands, 1893-1899.

[From Commerce and Navigation of the United States, Treasury Department.]

Year ended June 30 -	Japan.		China.		Hongkong.		Hawaiian Islands.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
BUTTER.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
1893.....	56,664	11,402	5,790	1,363	7,491	1,793	114,355	23,253
1894.....	58,189	11,531	5,708	1,312	5,000	1,048	72,558	15,992
1895.....	77,001	14,007	5,528	1,097	1,165	245	122,855	23,068
1896.....	101,751	18,103	20,277	3,709	3,536	708	128,847	23,243
1897.....	87,190	15,654	25,396	4,621	3,850	725	127,037	22,808
1898.....	115,293	23,097	21,555	4,688	13,315	2,779	152,367	34,561
1899.....	92,495	18,562	22,337	5,159				

¹ It is reported that a refrigerator plant has just been installed on a sailing vessel between San Francisco and the Hawaiian Islands and refrigerated compartments will be open for perishable articles.

Exports of butter and cheese from the United States to Japan, China, Hongkong, and Hawaiian Islands, 1893-1899—Continued.

Year ended June 30—	Japan.		China.		Hongkong.		Hawaiian Islands.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
CHEESE.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
1893.....	10,480	1,355	31,000	4,122	15,348	1,980	77,158	9,944
1894.....	14,153	1,884	29,104	3,777	9,973	1,323	80,787	10,290
1895.....	13,051	1,553	28,787	3,507	17,367	2,052	87,615	10,113
1896.....	31,960	3,603	35,290	3,779	16,681	1,922	93,795	10,761
1897.....	40,935	4,433	41,609	4,589	81,380	9,168	100,585	11,073
1898.....	35,594	3,867	44,234	4,817	93,205	10,106	138,975	14,975
1899.....	52,580	5,065	101,950	11,161				

In this connection it is interesting to note that thus far the total shipments from the Pacific coast have not been large. The following table shows the exports of butter and cheese in recent years from the two principal exporting districts—San Francisco and Puget Sound. By comparing the two tables it will be seen that only a small part of the total exports are sent across the ocean. As a rule, less than 25 per cent of the butter leaving the Pacific coast goes to China, Japan, and Hongkong. A large proportion of the exported butter is packed with brine in firkins.

Exports of butter and cheese from San Francisco and Puget Sound, 1893-1898.

[From Commerce and Navigation of the United States, Treasury Department.]

Year ended June 30—	San Francisco.		Puget Sound.	
	Quantity.	Value.	Quantity.	Value.
BUTTER.	Pounds.	Dollars.	Pounds.	Dollars.
1893.....	409,423	84,242	6,116	1,580
1894.....	444,740	92,538	25,695	5,569
1895.....	333,506	60,621	35,367	7,279
1896.....	386,422	60,144	49,118	9,497
1897.....	421,191	74,268	113,676	21,915
1898.....	525,490	113,743	93,740	20,446
CHEESE.	Pounds.	Dollars.	Pounds.	Dollars.
1893.....	227,491	29,712	11,301	1,252
1894.....	229,580	31,176	2,628	386
1895.....	214,805	26,374	6,502	696
1896.....	216,773	24,107	5,957	720
1897.....	352,202	39,225	19,664	2,499
1898.....	382,859	41,463	12,623	1,707

UNNATURAL CONDITIONS OF HOME MARKETS.

Although as much butter is probably made in California as is used in the State, the production is so uneven that at certain seasons of the year it is found necessary to import from the East. Large quantities of cheese are also sent from New York and Wisconsin to supplement the output of the home factories. Frequently the goods shipped in are not the best. They usually sell well, however, as they meet little

competition with superior grades. This peculiar condition will not last when the Coast production has further increased.

DAIRY MANAGEMENT.

The various grain feeds commonly used by dairymen in the East are seldom used in California. The feeding stuffs principally depended upon are natural pasturage, alfalfa, roots, and hay. The climate is so mild that the pasture season is unusually long; in fact, in some districts it has no end. In Humboldt County grain is not fed; cows are pastured the entire year. The pasture is principally red clover and Italian rye grass, and it is supplemented in fall and winter with green peas, carrots, beets, corn fodder, and hay. That the cattle do well with this care is shown by the fact that some herds of grade stock average over 300 pounds of butter per year, and the cows, as a rule, are in good condition.

In the alfalfa districts one hears almost incredible reports concerning the productiveness of the soil. Enormous crops are common, and five or six cuttings a year are not unusual. Irrigation is practiced to a considerable extent. Here, too, grain is seldom used. When cows are grazing they are usually given a small amount of hay at night, and a little bran is occasionally fed. One dairyman, who paid \$175 an acre for his 40-acre ranch, reports that he receives about \$100 per month from the creamery for the milk of his 30 cows. He uses no grain, pastures eight months, and feeds hay four months each year. His herd consists of ordinary grades and fairly represents many others which have been built up within a short time from stock which is better for beef production than for the dairy.

It is stated on good authority that a dairyman in Yolo County fed 90 milch cows in a corral from March 10 to July 18, 1897, on alfalfa cut from 32 acres. No other feed was used. The cows gave satisfactory results in milk yield and were in better condition at the close of the period than at the beginning. The custom of keeping cattle out of doors is made possible by the prevailing mild climate. On many ranches the animals never go under a roof to be milked or for any other purpose.

These facts make it evident that the California dairymen have good cause to boast of their ability to produce milk cheaply. As might be expected, they have much room for improvement. They admit that in many ways their methods are extravagant, and not a few of them are leading in movements toward economy. The more careful selection of cows for the dairy, and especially the selection of good stock for breeding, is a line of improvement which would show splendid results. This general subject was fully discussed in an early bulletin of the Dairy Division of this Bureau (Dairying in California), and need not be further referred to here.

BEET-SUGAR BY-PRODUCTS.

But something should be said of the use as feed of sugar-beet pulp and tops, which, though comparatively recent, is very common in some localities. Sugar beets are extensively raised in the vicinity of beet-sugar mills, of which there are several in the State. Three such districts were visited, namely, Alvarado, Watsonville, and Salinas. As a matter of general interest it may be stated that a good crop of beets runs about 15 tons to the acre, and the price for the year 1899, as agreed upon in advance by the sugar companies and the farmers, is \$4.50 per ton. During the harvesting season there is on some days an almost continuous procession of two, three, four, and six horse beet wagons on every important road leading to the factories. The roots are loaded onto strong nets in high wagon racks and are quickly tumbled into the bins by raising one side of the net with the aid of a steam engine and tackle.

Sugar-beet pulp.—Sugar-beet pulp,¹ which is the principal by-product in the manufacture of beet sugar, is usually sold for 25 to 30 cents a ton at the factory. Last year the price was as high as 50 cents. As it can be held a long time in silo and is fed to best advantage when old, it is available the entire year. The use of fresh pulp is said to reduce the milk flow. It is supposed to be good when a few weeks old and better at six months, and will keep two or three years.

When fresh the pulp is piled or placed in a silo (Pl. XIII, fig. 1), where it remains undisturbed until needed for use. The material is so soft and moist that if a large pile is dumped in the corner of an inclosed space it will gradually settle until the surface is almost level. Of course the top part decays, and after a time the entire mass is covered with a protecting layer from 3 to 6 inches in thickness. Within a few months the individual pieces of beet which were originally 2 or 3 inches long and quite slender are broken down, and the appearance of the material reminds one of cold mush, grayish brown in color. Three tons of fresh pulp make about 1 ton cured.

Pulp has a tendency to fatten, and it is given to beef cattle without the addition of any other food, but for milch cows its effect is found to be best when used with a little grain or hay. Without these latter it is supposed to produce a thin and watery milk. One feeder uses corn with pulp; another feeds about 3 pounds of bran daily. When

¹ The average analysis of diffusion pulps is given by Mr. G. L. Spencer in the 1898 Yearbook as follows:

Moisture	89.09
Nitrogenous matter .....	.92
Digestible carbohydrates	6.52
Indigestible carbohydrates	1.98
Fat .....	.09
Mineral matter	1.40
Total	100.00

pulp is fed in considerable quantity the animals do not care for water, and may go for months without a drink. A feeder who has been using this by-product several years complains that when his cows have been fed for a long time on pulp their calves are likely to come weak and be troubled with scours. Another dairyman of less experience who feeds the pulp fresh states that in his observation it has no bad effect on the calves.

A herd of 200 milch cows kept near a beet-sugar factory about 40 miles south of San Francisco is given a daily ration of 60 pounds of pulp, 5 pounds of mixed ground grain, and a little hay. The cows were seen in the pasture and appeared to be in good health and flesh. The milking cows averaged almost 2 gallons each per day. Their milk is shipped to a dealer in San Francisco, who pays $12\frac{1}{2}$ cents per gallon for it the year through and $1\frac{1}{2}$ cents per gallon for railroad freight. The production is greatest from February to May. Butter made from milk of this herd, for experimental export, was found to have exceedingly good body, a satisfactory flavor, and an apparently first-class keeping quality.

On a ranch near Watsonville, which supplies milk to a creamery, pulp has been used a few months each year for the past eight years. About 100 pounds a day are given to each animal.

It is the general opinion that pulp causes the butter to be hard.

Sugar-beet tops.—By "beet tops" is meant the leaves and the extreme top parts or crowns of the beets cut off when the beets are being piled ready for hauling. They are available during the harvesting of the crop, which lasts about three months. (See Pl. XIII, fig. 2.) This portion of the crop has some fertilizing value, and it is often plowed under on that account. Indeed, some beet-sugar companies which own large tracts of land forbid the removal of the tops. But considerable quantities of beet tops are fed, and good results are claimed. The market value of this feed depends almost entirely on the prices of other feeding stuffs. When feeds are high, tops sell for \$3.50 to \$4 per acre on the ground. This year (1899) the price is about \$2.50. It is best to allow the tops to wilt two or three days before being gathered and fed. They are then easily handled and not so liable to physic the cows as when used fresh. If they become crisp, a few green leaves are mixed with them before feeding. Unlike the pulp, they cause the animals to desire a large amount of water. Many farmers feed the tops alone, but it is claimed to be better to use a little bran with them. Evidently they are satisfactory to the cows, as little else is eaten when the cows are turned out to pasture. Some people claim that beet tops give a peculiar flavor to the butter, but only a few made this criticism.

One dairyman brought his entire herd of 90 grade Durham and Holstein cows from his own ranch to a beet farm where he had bought the privilege of using the tops. After the crop has been gathered he will move back to the home place. At the date of the visit of the

writer the cows had been fed on beet tops five days and were running on wheat stubble. The owner stated that their milk yield had doubled in that short time, the average being almost 2 gallons a day. Before the removal hay was the principal feed. This man makes the butter himself and sells it in the local market at highest San Francisco prices. It is always hard when he is feeding beet tops. A dairyman who feeds beet tops two or three months each year states that one September he sent a barrel of butter made from beet-top milk to a mining camp. It was packed in rolls and covered with brine, and it lasted so long, remained hard, and kept so well under unfavorable conditions that it attracted much attention, and orders were received for more of the same kind.

CALIFORNIA CREAMERIES.

There are about 300 creameries in California, and, judging by the few visited and what was reported of many others, they are well equipped and capable of doing good work. It appears that they are, as a rule, profitable investments. The charge for making butter is commonly as high as $3\frac{1}{2}$ cents per pound, and until quite recently creameries charged $4\frac{1}{2}$ cents. One establishment, now receiving daily 10,000 pounds of milk from 70 patrons and averaging about 7 tons of butter per month, has been in operation four years, and during that time almost \$5,000 from the regular earnings have been invested in permanent improvements, besides paying good dividends. Inasmuch as it took some time to grow from a small beginning, this is a good record.

As a rule, the creameries run every day of the year. The output of the one just referred to, which is in an alfalfa district, is largest in May, being $8\frac{1}{2}$ tons last May; in April 8 tons were made; in November $6\frac{1}{2}$ tons, and in December $5\frac{1}{2}$ tons—the smallest monthly output.

In equipment the creameries are quite similar to those in the East. Box and combined churns, separators, vats, in fact, practically all of the apparatus is from the East. One plant, receiving in September 14,000 pounds of milk a day and the cream of as much more from its two skimming stations, uses an ice-making machine capable of producing 3 tons of ice in a day; the direct expansion system is used. A large tank of brine is suspended near the top of the butter room, and when it is desired to shut down the ice machine the brine is thoroughly cooled, and it keeps the temperature in the workroom low until the machinery is again started. This creamery had the honor of making and packing in 3-pound cans 3 tons of butter for the U. S. S. *Oregon* for her famous trip around the Horn. The butter was made in the usual way, except a little drier. It was reported to have been good to the last.

PAYMENT FOR MILK.

The method of payment for milk, as explained at two cooperative creameries, is as follows: Composite samples of each patron's milk are



FIG. 1.—SUGAR-BEET PULP SILO.



FIG. 2.—WILTED BEET TOPS FROM THE FIELD READY FOR FEEDING.





FIG. 1.—CREAMERY AT WATSONVILLE.



FIG. 2.—BUTTER CHESTS AWAITING TO BE PACKED.

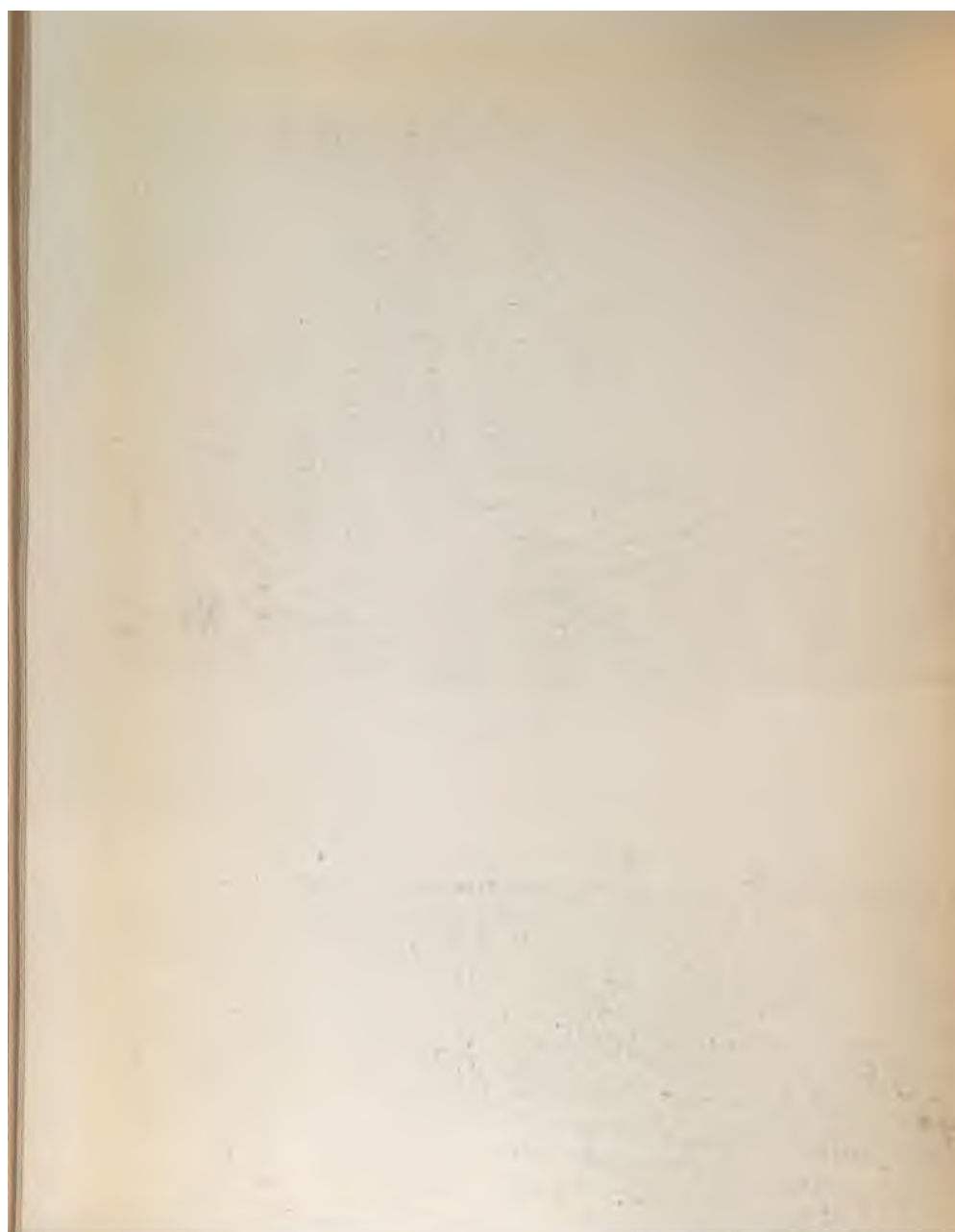




FIG. 1.—CUTTING SQUARES OF BUTTER.



FIG. 2.—WRAPPING SQUARES OF BUTTER.



tested by the Babcock test once or twice every month, and a statement of the amount of milk delivered by each person and the average tests is handed to the secretary early in the following month. The total amount of butter made and any deliveries to patrons are also reported at the same time. The secretary computes the amount of fat brought by each patron and the total. The overrun is then determined (and it is usually found to be about 16 per cent). The fat delivered by the different patrons is increased in the proper proportion and each is credited with the delivery of a certain number of pounds of butter. The receipts from sales of butter made during the month are reduced by the creamery charge for making (3 or 3½ cents per pound), and the net average rate to be paid to the patrons is determined by dividing the amount of money remaining after this reduction by the number of pounds of butter delivered. The amount due each patron is then found by multiplying the number of pounds of butter credited to him by the average rate. Any charges for butter are deducted, and checks for the balance are delivered about the middle of the month.

The method may be illustrated as follows: Suppose a creamery receives in June 30,000 pounds of milk testing 3 per cent fat from A; 40,000 pounds of 3.4 per cent milk from B; 50,000 pounds of 3.7 per cent milk from C; 60,000 pounds of 4 per cent milk from D, and the total amount of butter made is 7,550 pounds. The operator reports these figures to the secretary, who fills them in the first two columns of a blank form, as shown below; the remaining numbers are then calculated from them and the data received from the sales agent. The work is sometimes done with great accuracy by carrying the decimals out several points, so that each patron always receives the exact number of cents due him. Frequently the secretary of the creamery slightly increases or decreases the amount to be distributed by changing the rate of payment a few hundredths of a cent per pound so as to enable him to use round numbers in his calculations instead of awkward figures. The difference is adjusted the following month. This system of borrowing from or loaning to the next month is very sensible. It greatly simplifies the secretary's work and, at the most, makes a difference of only a few cents in the returns to the various patrons, and these small amounts are not taken from them or given to them, but simply borrowed or loaned for a month.

Smithville creamery.—Statement for June, 1899.

Patron.	Milk delivered.	Average test.	Fat delivered.	Equivalent in butter.	Amount due.	Charges.	Checks.
	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>			
A.....	30,000	3	900	1,044	\$229.08	\$2.00	\$227.08
B.....	40,000	3.4	1,360	1,577.6	347.07	.....	347.07
C.....	50,000	3.7	1,850	2,146	472.12	1.50	470.62
D.....	60,000	4	2,400	2,784	612.48	5.50	606.98
Total.....	180,000	.....	a 6,510	b 7,551.6	61,631.35	9.00	1,632.35

a Overrun 16 per cent.

b At 22 cents.

Fat delivered.....	6,510
Butter made.....	7,551.6
Overrun, 16 per cent.	
3,000 pounds, at 25.5 cents.....	\$76.50
2,000 pounds, at 25 cents.....	50.00
Sales.....	
2,000 pounds, at 24.5 cents.....	49.00
551.6 pounds, at 24.1 cents.....	132.95
7,551.6	1,087.95
7,551.6 pounds, at 25 cents.....	1,887.90
Charge for making, 3 cents per pound.....	226.45
Amount due patrons, 7,551.6 pounds at 22 cents.....	1,661.35

When there are many patrons it is seen that the number of calculations is very large. This laborious work could easily be lessened. The column headed "Equivalent in butter" might well be omitted, thus saving one series of multiplications. Payments could be based on the amount of fat delivered, the average price per pound being found by dividing the sum to be distributed by the pounds of fat delivered, or, in the above case, \$1,661.35 by 6,510, which gives 25.52 cents as the value of each pound of pure fat. This rate, with the numbers in the column headed "Fat delivered," shows the same amounts due the patrons as obtained by the longer method illustrated above.

HANDLING ALFALFA MILK.

Butter made from milk of alfalfa-fed cows is liable to have a peculiar flavor unless special care is taken in the handling of the cream. It is customary to separate a very heavy cream and to hasten the ripening in order to exclude or cover undesirable flavors. The cream tests about 40 per cent fat, and the use of homemade or commercial starters is not uncommon. In one creamery the cream is stirred continually for five hours after it is put into the vat. No doubt this serves to aerate it and partially remove undesirable flavors. The cream is churned when from twenty to twenty-four hours old and the butter is immediately prepared for market.

CALIFORNIA SQUARES.

Practically all the best creamery butter sold on the Pacific coast is in squares of about 2 pounds each. The squares are blocks with square ends and rectangular sides. The butter is packed on a table (Pl. XV, fig. 1) fitted with sideboards as high as the squares stand when on end. The top surface is carefully leveled even with the table sides, and the squares, a number at a time, are cut by wires. They are wrapped in parchment paper (Pl. XV, fig. 2) and packed on end in heavy wooden chests (fig. 1). This method of handling butter is excellent in some respects, but it is subject to criticism on two important features: First, there is now no uniformity in the weights of the squares. One creamery sends cases of sixty 1½-pound squares, or 105 pounds, to Sacramento, and to the same market

another creamery sends cases holding sixty squares, aggregating 101 pounds. This latter creamery also sends to San Francisco cases holding sixty squares of 93 pounds. It must be both confusing and annoying to handle squares of such varying weights, and no really good reason for the practice was found. Doubtless many people who purchase butter do not notice the difference in weights, but consider all squares alike, and the seller who can shave off the most without being suspected is the gainer. Such competition is not only discreditable but dishonest. The second criticism of the method of marketing butter relates to the packages. Eastern dealers have learned that it is more economical and satisfactory in many ways to use cheap but neat boxes for shipping, which do not have to be returned, than to use the heavy and expensive trunks or chests that were so common only a few years ago. These latter are continually being lost and broken, cause annoyance at both ends of the line, and require much labor for proper cleaning (and this is too often neglected), while the cheaper packages have not these objections.

CHEESE MAKING.

California dairymen and commission men are willing to admit that their State does not produce much cheese suitable for export. As a rule it is soft, open, and moist, and must be used soon after it is made. The trouble, in all probability, is due to improper methods of manufacture, and the surest method of remedying the matter is to teach the science of cheese making and the systems successfully followed elsewhere. If such instruction were offered, there is no doubt that those interested would avail themselves of it.

Only one cheese factory was visited, a private concern on a ranch of 4,000 acres. Here the milk from 130 cows, mostly grade Durhams, is manufactured into "Flats" and "Young Americas." The factory is a neat little one-story, square, brick structure, containing a curing room on the main floor and another below the level of the ground for use in hot weather. It is well equipped for making a fine article of cheese.

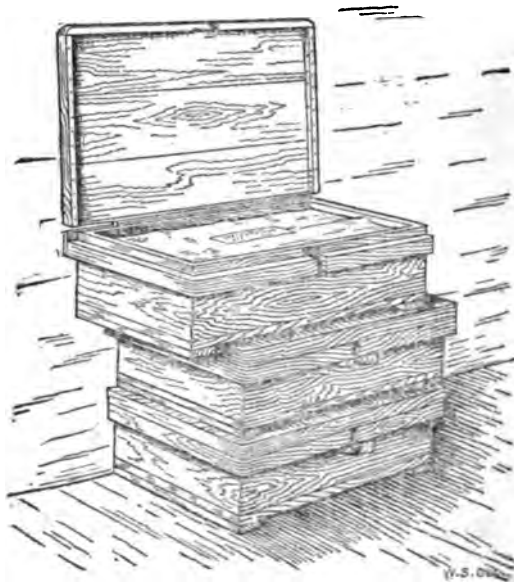


FIG. 14.—Butter packed ready for shipment.

CITY MILK SUPPLY.

As in many other parts of the country, the business of supplying milk to California cities is in an unsettled state. There is a lack of cooperation between milk producers, health officers, and milk consumers, which is detrimental alike to the interests of those who have good milk for sale and those who wish to purchase it. Methods adopted by public officials for improving the milk supply sometimes result in more harm than good.

Unclean dairies have been so widely advertised in official reports and newspaper articles that many citizens think well-conducted dairies do not exist, or, if they do, no way is known by which one can be assured of getting their milk. And many persons will go without milk whenever possible rather than run the risk of getting the dangerously impure article which they are convinced is very common. Thus the scare articles have the effect of reducing the production and use of impure milk; but they have the same effect also on the use of pure milk. It is unfortunate that the excellent features of the best dairies are not given as much prominence as are the defective features of the worst, so as to show those interested that good milk is on the market as well as bad. A practicable plan by which this could be accomplished could easily be followed, greatly to the benefit of all concerned.

Although only a few dairies were visited, it was readily seen that at least a part of the milk going into Sacramento and San Francisco is produced with great care and can be relied upon as a safe and wholesome food. As already suggested, if these first-class dairies and others like them could be brought to the attention of the public as forcibly as the worst types, a decided step would be taken toward the improvement of the general city supply.

DAIRY EDUCATION.

In striking contrast with California's characteristic energy in advancing the interests of many of her industries in every possible way, the one method of promoting dairying, which in other States is considered of the greatest importance, has thus far been neglected. The State is doing nothing in the line of special dairy instruction, and her dairy interests are suffering in consequence. The reason may be that this branch of agriculture has not until recently become one of the important industries of the State, and those having power to assist in its promotion have not yet realized its great possibilities. Efforts to establish a State dairy school have been made, but without success. It was a subject of discussion at the darymen's convention, and its friends will continue to agitate it, hoping that a school will be opened in the near future.

The necessity for such a school is readily seen. In the past few years there have been many improvements and changes in dairy oper-

tions, and the improvements and changes still continue. Butter and cheese makers who now follow comparatively recent but really out-of-date methods are working at a great disadvantage. New forms of machinery are constantly being introduced, methods of manufacture are being perfected, market requirements are becoming more strict, and competition is growing more keen. In order to keep up with competitors at home and abroad it has been necessary to provide for giving instruction in the latest dairy methods, and special schools have been established in all the leading dairy States to meet this urgent need. It has been found best to connect them with State agricultural colleges, making use, so far as possible, of the latter's equipment.

In a few States splendid buildings have been erected for the exclusive use of the dairy schools. In other dairy States where there is less call for instruction, there is less pretentious equipment, but the training offered is none the less complete. At Cornell University, New York, there is a building erected and equipped at a cost of \$50,000, devoted exclusively to dairy instruction, and every year about seventy-five men are given a three months' course of lectures in breeding and feeding of dairy cattle and the manufacture of butter and cheese and practical work in a model creamery and cheese factory. At the State experiment station of the same State a \$40,000 building has recently been erected to be used chiefly as a laboratory for studying dairy problems for the benefit of the dairy interests of the State. At Madison, Wis., there is another dairy school building, which cost about \$40,000 and where more than a hundred dairy students are trained every winter. The wonderful growth of dairying in that State is attributed largely to the influence of the dairy school, graduates of which can be found in charge of successful cheese factories and creameries in almost every county. The dairy school at Ames, Iowa, is conducted in connection with a large creamery. Students are in attendance at all times of the year. Special sixteen weeks' courses are given to beginners and a four weeks' winter course is conducted each winter for experienced butter makers. Over 100 students are instructed every year. The cost of maintaining the school is less than \$3,000 per year, and a part of this is earned by the creamery. This school and others have furnished experienced butter and cheese makers to California. The other leading dairy States are also well equipped for giving instruction. Quite recently the legislature of Kansas appropriated \$34,000 for building and equipping a dairy school in that State.

Special instruction in dairying is offered at more or less well-equipped schools in thirty-one States. California is the only one in which the industry is at all prominent that is not on the list. The need of a dairy school in California is very apparent. The annual reports of the State board of trade show the importance of the dairy industry as compared to others. The value of California dairy products is equal

to two-thirds the value of her gold output and far exceeds the value of any other mineral product. The dairy products are worth almost half as much as the wheat crop and about half as much as the combined crops of all kinds of fruit. The receipts from sales of butter, cheese, cream, and milk amount to nearly double the annual expenditures for the support of the public schools. According to the last census California ranks in dairying with other States as follows: Seventeenth in the total number of cows; seventeenth in total butter product; ninth in total cheese product. Yet thirty-one States are ahead of her in encouraging and promoting dairying by offering special dairy instruction. It is seen that the dairy interests of many of them are smaller than those of California, both in toto and in comparison with other industries.

It is said to be a difficult matter to find capable operators of butter and cheese factories; and the same is true of helpers, even though these latter receive higher wages than farm laborers. As stated above, some well-trained factory operators have gone to California from other States. In addition to these there are some, of course, who have been successful in picking up their business at home and a few who have gone East for their dairy training and then returned to the State. But the majority of the butter and cheese makers of any large State will not be as well trained in their professions as they should be for the good of their work until a dairy school is maintained in that State and they shall have availed themselves of its advantages. This applies with special force to California, because it is so far from other leading dairy States, and the expensive journey to their schools will prevent many from going away for dairy training who might do so if the distances were shorter.

STATISTICS OF OLEOMARGARINE, OLEO OIL, AND FILLED CHEESE.

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OLEOMARGARINE.

Although oleomargarine is not a dairy product it is an article which interests many persons connected with dairying because of its use as a substitute for butter, and more especially because of its fraudulent sale as genuine butter.

Reliable statistics of the production and distribution of oleomargarine previous to 1886 are not available; but in the latter part of the year named Congress enacted a law imposing taxes on the product and placing its manufacture and sale under the supervision of the Bureau of Internal Revenue of the Treasury Department, and the reports of that office contain authentic information as to the production and distribution of the article in the United States. The export of oleomargarine is reported by the Bureau of Statistics of the same Department. The statistics below are from reports of these Bureaus.

The law defines oleomargarine as "All substances heretofore known as oleomargarine, oleo, oleomargarine oil, butterine, lardine, suine, and neutral; all mixtures and compounds of oleomargarine, oleo, oleomargarine oil, butterine, lardine, suine, and neutral; all lard extracts and tallow extracts; and all mixtures and compounds of tallow, beef fat, suet, lard, lard oil, vegetable oil, annatto, and other coloring matter, intestinal fat, and offal fat made in imitation or semblance of butter, or, when so made, calculated or intended to be sold as butter or for butter."

Any article coming within this definition must be packed and plainly labeled as prescribed in the law and in the regulations of the Treasury Department which are authorized by the law. Taxes are imposed as follows:

All oleomargarine for domestic use is taxed 2 cents per pound.

Manufacturer's special tax, \$600 per annum.

Wholesale dealer's special tax, \$480 per annum.

Retail dealer's special tax, \$48 per annum.

A summary statement of the operations in oleomargarine for each fiscal year since the law went into effect (Tables I and II) shows that, although there has been considerable fluctuation in the business, it is increasing rapidly. The smallest annual production was 32,324,032

pounds for the year ended June 30, 1890—an average monthly production of 2,693,669 pounds. The next smallest was 34,325,527 pounds for the fiscal year 1888—the first full year in which reports were made. The largest annual production was reported for the last fiscal year, ended June 30, 1899, and amounted to 83,139,901 pounds, or an average of 6,928,325 pounds per month. This was a large increase over the next largest year, 1894, with 69,622,246 pounds, and it was almost 85 per cent more than the amount reported two years previous, in 1897, namely, 45,531,293 pounds.

The total revenue received from oleomargarine sources (Tables I and IX), of course, varies in the same way, the smallest amount for a full year being \$786,291.72 for 1890, and the largest \$1,956,618.56 for the year ended June 30, 1899.

The months of largest production are quite uniformly those when the prices of butter are high (Tables III and IV); and the output is least when butter prices are low. Without exception, the month of smallest production has been June or July. It is interesting to note how closely the variations in oleomargarine production and butter prices are alike. (Diagram A.)

The headquarters for the manufacture of oleomargarine is the first Illinois district¹ (Tables V and VIII), which produced in the last fiscal year almost 39,000,000 pounds, or 46.8 per cent, of the total; the 2-cent and manufacturers' special taxes amounted to \$776,659.80. Kansas is the next in importance, having produced 16 per cent of the total product of the same year, and paid, in the two forms of tax just mentioned, \$265,827.64. The eleventh Ohio district ranked third, with 12 per cent of the total production. The Connecticut district, which includes Rhode Island where all the oleomargarine is made, ranked fourth in 1899, with 9.5 per cent, and the sixth Indiana district was fifth, with 8.5 per cent.

The relative importance of the various districts does not remain the same; but the one which includes the packing houses near Chicago is always a heavy producer, and, though less important, the Connecticut and Kansas districts also always turn out large quantities of oleomargarine. The article is usually produced in about ten different districts. In the last year a total of seventeen manufactories were located (Table VII) in seven States—Illinois, Indiana, Kansas, Missouri, New Jersey, Ohio, and Rhode Island—and the District of Columbia. There has been practically no change in the producing localities in the last three years.

In compliance with a special resolution of Congress, the amounts of oleomargarine shipped into each State in the last fiscal year have been reported (Table VI), and it is shown that over 18,500,000 pounds, or 23.3 per cent, of the total production went to Illinois, the largest producing State. Pennsylvania received almost 11,500,000 pounds,

¹ Reference is to internal revenue districts.

or 14.3 per cent. Ohio took almost 9,000,000 pounds. A few other States, in order of amounts received, are as follows: New Jersey, nearly 6,000,000 pounds; Indiana, Rhode Island, and Missouri, between 3,000,000 and 4,000,000 pounds each; Michigan and Massachusetts, between 2,000,000 and 3,000,000 pounds each; and between 1,000,000 and 2,000,000 pounds went to each of the States of Maryland, Kansas, Texas, Kentucky, Minnesota, West Virginia, Virginia, Colorado, Louisiana, and Nebraska.

These figures are strong evidence that oleomargarine is sold not only for use instead of butter, but as butter itself. The well-enforced laws of New York and Iowa prohibit its sale as butter, and the amounts sent into those States were less than 225,000 and 80,000 pounds, respectively.

The special report giving exact amounts shipped into each State is hardly necessary, however, to show where the chief business is done. The same is indicated fairly well by the numbers of oleomargarine dealers, wholesale and retail, which are reported by States for each year since the law took effect (Table VII.) The amount of sales in various States is, of course, not in direct proportion to the number of selling agencies, but there is a close relation between the two. The first seven States named above as receiving the largest amounts of oleomargarine in 1899 also had the largest numbers of retail dealers, as follows: Illinois, 2,006; Ohio, 995; Pennsylvania, 696; Rhode Island, 326; Indiana, 298; New Jersey, 288; and Missouri, 229.

Only a small part of the oleomargarine manufactured in the United States is exported. The principal point of shipment is New York (Table X), whence 3,000,000 pounds left last year. Baltimore is next, with half as much. Shipments are also made through Philadelphia, San Francisco, Detroit, and other ports.

The months of largest and smallest exports (Table XI) are not uniform in different years, as would be expected. The amounts shipped out depend upon many conditions, such as the stock on hand, condition of home market, condition of foreign market, facilities for shipping, etc. In the year ended June 30, 1899, the heaviest exports were in the first three months, July, August, and September, which averaged almost 700,000 pounds each; in December and January, the lightest months, the exports were about 50 per cent less. In the previous year the largest monthly exports were in August and May and the smallest in October and January. From 1876 to 1881 the exports of oleomargarine and oleo oil were reported together. (Table XII.) As the shipments of the oil were far in excess of the shipments of the imitation butter, according to the reports for 1882 and 1883, when they were recorded separately, the amounts of oleomargarine exported during the earlier years named can not accurately be stated or even closely estimated.

In the last eighteen years the largest amount of oleomargarine exported in a single year was 10,100,897 pounds in the fiscal year 1895. (Tables XV and XVI). The next largest was 6,063,699 in 1896, and the next 5,549,322 for the last (1899) fiscal year, which was an increase of about 1,000,000 pounds over the preceding year. In the last ten years the smallest amounts were exported in 1891 and 1892, being between 1,500,000 and 2,000,000 pounds in each case. It will be seen that the exports are not proportionate to the production. As the oleomargarine law provides that the product to be exported shall not be taxed and must be plainly labeled, it is probable that the exports for the last twelve years, at least, are accurately stated.

In explanation of the excess of actual exports (Table XV) over amounts withdrawn for export (Table I), it is stated that some oleomargarine is imported for reexport, and some oleomargarine upon which tax has been paid is exported, drawback being allowed.

The largest foreign purchasers of oleomargarine are Germany and the British West Indies. They took 1,965,559 and 1,527,342 pounds, respectively, in the fiscal year 1899. The next largest purchaser in the same year was the United Kingdom, to which 307,798 pounds were shipped. Other countries receiving more than 100,000 pounds were Danish West Indies, French West Indies, Cuba, Porto Rico, Colombia, British Guiana, Hawaiian Islands, and British Africa.

OLEO OIL.

Oleo oil constitutes about one-fourth of oleomargarine, and this use is a principal outlet for it. Statistics of production are not available for each year, as is the case with oleomargarine. The exports of oleo oil are reported as a matter of general interest in this connection.

From 1884 to 1888 the annual exports of oleo oil varied from 30,000,000 to almost 46,000,000 pounds. In 1889 they were a little over 28,000,000 pounds, and they gradually increased from that year until 1894, when they amounted to over 123,000,000 pounds. In 1895 they fell to 78,000,000, and from that time they have been rapidly and steadily increasing to over 142,000,000 pounds in 1899. (Tables XVII and XVIII.)

From an examination of the monthly exports of oleo oil for the past two years (Table XIV), it appears that the largest quantities are sent out between the first of March and the last of July. In the fiscal year 1898 the largest amount of oleo oil exported in a single month was almost 14,000,000 pounds in March. The largest month's business in the fiscal year 1899 was in June, when over 17,000,000 pounds were exported. The months of least exports are in the winter.

The principal point of export of oleo oil is New York City, whence a little over 90,000,000 pounds were exported during the past year. (Table XIII.) Baltimore is second in importance, with nearly 40,000,000 pounds last year. It is also sent from Philadelphia, Boston, Detroit, Huron, and Bangor.

Over 86,000,000 pounds, or 60 per cent, of the oleo oil exported in 1899 went to Netherlands. Germany took over 28,000,000 pounds, or about 20 per cent. The remaining nearly 20 per cent went to Sweden and Norway, the United Kingdom, Denmark, Belgium, and a few other countries which took small amounts. (Table XVII.)

FILLED CHEESE.

Filled cheese is more of a dairy product than oleomargarine, as skimmed milk is its principal constituent, the difference between it and whole-milk cheese being due to the substitution of other fats for the natural milk fats.

In the latter part of 1896 there went into effect a law of Congress imposing special taxes on filled cheese and placing its manufacture and sale under the supervision of the Treasury Department. Operations in this commodity are reported by the Commissioner of Internal Revenue, as has been explained above in the discussion of oleomargarine.

The law defines filled cheese as "All substances made of milk or skimmed milk with an admixture of butter, animal oils or fats, vegetable or any other oils, or compounds foreign to such milk, and made in imitation or semblance of cheese."

Any such article must comply with the provisions of the law and the regulations of the Treasury Department which the law authorizes. Taxes are imposed as follows:

All filled cheese is taxed 1 cent per pound.

Manufacturer's special tax, \$400 per annum.

Wholesale dealer's special tax, \$250 per annum.

Retail dealer's special tax, \$12 per annum.

From the time the filled-cheese law went into effect until the last of April, 1898, the production was principally for domestic use, and the amount made varied considerably from month to month. The largest monthly output during the last four months of 1896 was 61,900 pounds in October; the smallest, 20,428 pounds, in November. In both March and April of 1897 the output exceeded 300,000 pounds; in February, June, and December it was more than 200,000 pounds; in the other months it exceeded 100,000 pounds, except in July and August, when none was made. In 1898 the monthly production gradually fell from 230,684 pounds in January to 143,406 pounds in April, and this was the last month, when it was withdrawn for domestic use. None was made in May, 240 pounds were produced for export in June, then no more was made until December, when 71,856 pounds were produced for export. The monthly production from January to June, 1899, varied from 223,830 to 335,065 pounds—all for export. (Table XXI.)

Although the production by months has been very uneven the total annual production has not varied greatly, the largest amount being

nearly 1,700,000 pounds in the last fiscal year (1899). (Tables XIX, XX, XXI, and XXII.)

There are five manufactories of filled cheese and they are all located in Illinois (Table XXIII), and practically all of the internal revenue receipts, which amount to from \$16,000 to \$19,000 per year (Tables XXIV and XXV), are collected in that State. One retail establishment in the District of Columbia is reported to have paid a tax in the last fiscal year, but it does not appear that any filled cheese was sold there.

NOTE.—In a few instances slight errors have been found either in the totals or in the numbers added. When these errors can not be located, the figures are given as found in the reports.

TABLE I.—*Production and distribution of oleomargarine and total revenue receipts therefrom, 1887 to 1899.*

Fiscal year ended June 30—	Quantity produced.	Withdrawn tax paid. ^a	Withdrawn for export. ^b	Received, all sources.
	Pounds.	Pounds.	Pounds.	Dollars.
On hand Nov. 1, 1886.....	181,000			
1887 (from Nov. 1, 1886).....	21,513,537	20,743,569	724,532	723,948.04
1888.....	34,325,527	31,589,165	1,686,198	864,139.88
1889.....	35,664,026	33,863,642	1,748,895	894,247.91
1890.....	32,324,032	30,797,935	1,618,397	786,291.72
1891.....	44,392,409	43,215,512	1,229,116	1,077,924.14
1892.....	48,364,155	46,915,501	1,293,782	1,263,323.00
1893.....	67,224,298	64,463,875	2,785,494	1,670,641.50
1894.....	69,622,246	66,096,058	3,406,683	1,723,479.90
1895.....	56,958,105	53,636,242	3,337,186	1,409,211.18
1896.....	50,853,234	47,741,793	3,106,294	1,219,432.46
1897.....	45,531,293	42,508,469	3,148,407	1,034,129.60
1898.....	57,516,136	55,079,887	2,259,705	1,315,708.54
1899.....	83,139,901	79,701,108	3,095,738	1,956,618.56
Total.....	647,600,989	616,352,756	29,442,337	15,942,101.43

^a Two cents per pound.

^b Without tax.

TABLE II.—*Average monthly production and distribution of oleomargarine, 1887 to 1899.*

Fiscal year ended June 30—	Average monthly production.	Average monthly withdrawals.	
		Tax paid.	For export.
	Pounds.	Pounds.	Pounds.
Eight months ended June 30, 1887.....	2,689,192	2,592,946	90,566
1888.....	2,860,460	2,622,430	140,516
1889.....	2,972,002	2,821,970	145,741
1890.....	2,663,600	2,506,494	134,866
1891.....	3,699,367	3,601,292	162,426
1892.....	4,030,346	3,909,625	167,981
1893.....	5,602,024	5,371,989	232,124
1894.....	5,801,853	5,508,094	283,890
1895.....	4,746,508	4,469,686	278,098
1896.....	4,237,769	3,978,482	258,850
1897.....	3,794,274	3,542,372	262,367
1898.....	4,793,011	4,589,990	188,308
1899.....	6,958,325	6,641,750	257,978

TABLE III.—*Months of largest and smallest production of oleomargarine and amounts produced, 1887 to 1899.*

Fiscal year ended June 30—	Largest production.		Smallest production.	
		Pounds.		Pounds.
1887.....	March, 1887.....	3,568,254	June, 1887.....	1,375,423
1889.....	March, 1888.....	3,940,727	July, 1887.....	1,208,638
1889.....	December, 1888.....	4,181,317	June, 1889.....	1,575,362
1890.....	October, 1889.....	4,072,333	June, 1890.....	1,364,826
1891.....	March, 1891.....	6,723,224	July, 1890.....	1,723,006
1892.....	March, 1892.....	5,916,871	June, 1892.....	2,007,255
1893.....	January, 1893.....	7,824,657	July, 1892.....	2,653,622
1894.....	October, 1893.....	9,318,006	June, 1894.....	2,552,791
1895.....	October, 1894.....	7,046,429	June, 1895.....	2,399,826
1896.....	October, 1895.....	5,922,649	June, 1896.....	2,822,379
1897.....	March, 1897.....	4,820,677	June, 1897.....	2,600,795
1898.....	November, 1897.....	6,367,024	July, 1897.....	2,678,603
1899.....	December, 1898.....	8,964,073	July, 1898.....	3,762,028

TABLE IV.—*Monthly production and distribution of oleomargarine, November, 1886, to December, 1899.*

Year and month.	Quantity returned to factories.	Quantity produced.	Withdrawn, tax paid.	Withdrawn for export.	Lost or destroyed.	Withdrawn for exposition purposes.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
On hand Nov. 1, 1886.....		181,000				
November.....		3,188,261	2,966,241	6,747	10,878	
December.....		3,073,263	2,953,827	67,189	296	
1887.						
January.....		2,804,006	2,720,235	144,535	3,056	
February.....		2,779,855	2,716,759	60,500	9,182	
March.....		3,568,254	3,512,138	96,499	12,472	
April.....		2,830,358	2,789,307	149,838	6,806	
May.....		1,885,027	1,760,954	136,523	2,210	
June.....		1,375,423	1,301,108	62,701	6,267	
July.....		1,208,638	1,170,136	33,240	1,191	
August.....		2,425,220	2,296,238	110,000	601	
September.....		2,703,256	2,568,007	68,917	262	
October.....		3,082,935	2,015,016	92,201	1,079	
November.....		3,003,715	2,862,321	148,899		
December.....		3,256,628	3,120,303	78,500		
1888.						
January.....		3,058,955	2,918,808	117,781		
February.....		3,057,149	3,003,515	126,168		
March.....		3,940,727	3,824,672	155,761	2,998	
April.....		3,273,453	3,062,396	251,094	1,537	
May.....		3,185,127	2,817,202	327,726		
June.....		2,130,318	1,930,311	174,621	995	
July.....		2,084,317	1,925,782	155,200	185	
August.....		2,301,769	2,209,782	153,285	727	
September.....		2,776,465	2,611,663	167,787		
October.....		3,462,123	3,308,418	80,785		
November.....		3,734,878	3,509,408	175,965		
December.....		4,181,317	4,025,336	109,385	10	

TABLE IV.—*Monthly production and distribution of oleomargarine, etc.—Cont'd.*

Year and month.	Quantity returned to facto- ries.	Quantity produced.	Withdrawn, tax paid.	With- drawn for export.	Lost or de- stroyed.	Withdrawn for exposi- tion pur- poses.
1889.	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
January		3,607,753	3,353,350	137,123		
February		3,523,381	3,206,245	228,191	1,000	
March		3,047,875	3,077,831	70,424		
April		3,057,841	2,886,481	285,918		
May		2,310,945	2,114,678	126,223	70	
June		1,575,362	1,514,658	58,579		
July		1,404,749	1,442,094	95,580		
August		1,975,773	1,914,016	49,222	4,973	
September		2,274,456	2,130,648	167,826		
October		4,072,333	3,668,057	190,385	688	
November		3,188,757	3,174,648	121,630		
December		3,072,028	3,010,319	93,770		
1890.						
January		3,338,340	3,053,375	117,900	3,692	
February		3,011,670	3,042,219	104,018	256	
March		3,885,080	3,657,614	213,680		
April		2,871,274	2,719,725	159,119		
May		1,864,746	1,795,963	219,052		
June		1,364,826	1,189,257	86,215	90	
July		1,723,966	1,573,786	157,808		
August		2,330,548	2,135,414	192,175	56	
September		3,391,817	3,139,816	146,920		
October		3,626,035	3,482,124	95,660	3,856	
November		3,615,704	3,615,132	71,400		
December		4,373,447	4,238,578	21,090		
1891.						
January		3,654,473	3,702,844	36,158		
February		4,386,152	4,340,304	46,330		
March		6,723,224	6,577,926	62,170		
April		4,573,178	4,443,605	288,966	1,039	
May		4,005,212	3,907,827	39,904		
June		1,988,633	2,049,156	70,445		
July		2,524,287	2,428,144	38,970		
August		2,376,022	2,276,389	104,008		
September		3,560,418	3,435,513	45,050		
October		4,941,276	4,825,731	71,998	112	
November		4,975,162	4,813,457	91,800		
December		4,593,610	4,570,557	68,775		
1892.						
January		4,777,319	4,563,758	83,306		
February		4,864,932	4,607,287	218,570		
March		5,916,871	5,711,766	180,000		
April		4,605,392	4,711,950	122,563		
May		3,160,611	2,935,407	134,198		
June		2,067,255	2,035,592	127,364		
July		2,653,622	2,388,926	284,558		
August		3,745,521	3,571,333	144,870		
September		5,116,208	4,698,580	145,853		
October		5,195,351	5,239,310	219,263		
November		7,311,563	6,707,850	224,732		
December		6,541,521	6,232,957	284,058		

TABLE IV.—*Monthly production and distribution of oleomargarine, etc.*—Cont'd.

Year and month.	Quantity returned to facto- ries.	Quantity produced.	Withdrawn, tax paid.	With- drawn for export.	Lost or de- stroyed.	Withdrawn for exposi- tion pur- poses.
1893.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
January		7,824,657	7,686,636	223,033		
February		6,383,115	6,068,662	233,048	4,525	
March		6,358,576	6,249,313	239,106	3,828	
April		6,378,648	6,253,313	305,957	1,939	
May		6,242,756	5,809,198	264,392		1,214
June		3,472,760	3,536,501	217,604		
July		3,653,387	3,350,268	233,894	1,506	
August		5,014,242	4,716,712	222,354		
September		7,126,593	6,739,234	230,283		228
October	228	9,318,006	8,731,547	265,147	228	
November	450	7,401,265	7,280,926	302,468	450	
December		6,809,238	6,577,978	177,320		
1894.						
January		6,566,191	6,215,278	25,839		
February		6,243,843	6,127,589	287,461	643	
March		5,889,497	5,639,414	415,549	61	
April		5,413,302	4,956,192	358,951		
May		3,633,891	3,443,917	328,171	2,691	
June		2,552,791	2,317,003	339,196		
July		3,028,980	2,695,799	257,784		
August		5,429,045	4,756,713	262,076		
September		5,928,516	5,902,883	317,141		100
October	100	7,046,429	6,616,097	338,673	100	
November		6,633,846	6,297,673	290,424		
December		5,075,604	4,834,587	242,503		
1895.						
January		5,030,335	4,900,591	244,102	4,029	
February		4,803,201	4,625,389	211,471		
March		4,318,972	4,021,562	359,255	19,458	
April		3,967,691	3,820,075	255,985		
May		3,295,600	3,012,370	267,166		
June		2,399,826	2,192,553	290,606	4,480	
July		3,003,913	2,689,369	301,633		
August		3,547,363	3,240,923	273,950		
September		3,887,134	3,820,689	155,893	300	
October		5,922,649	5,357,691	330,129		
November		5,290,905	4,995,014	318,798		
December		5,436,280	5,033,087	205,319	1,760	
1896.						
January		4,830,851	4,735,497	228,860	40	
February		4,501,881	4,355,331	204,327		
March		4,962,718	4,642,891	293,626		
April		3,741,993	3,630,624	247,033		
May		2,929,162	2,697,332	241,231		
June		2,822,379	2,563,345	303,705	330	
July		2,610,739	2,405,071	164,289		
August		2,647,753	2,495,435	233,653		
September		3,478,137	3,257,578	186,149		
October		4,734,809	4,208,662	312,218	1,135	
November		3,602,184	3,455,106	324,844		
December		4,740,937	4,424,367	361,287	650	

TABLE IV.—*Monthly production and distribution of oleomargarine, etc.—Cont'd.*

Year and month.	Quantity. returned to facto- ries.	Quantity produced.	Withdrawn, tax paid.	With- drawn for export.	Lost or de- stroyed.	Withdrawn for exposi- tion pur- poses.
1897.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
January		4,240,212	4,030,944	175,770	180	
February		4,171,130	3,742,250	387,528		
March		4,826,677	4,604,195	290,970		
April		4,323,737	4,085,153	197,073		
May		3,494,183	3,313,301	249,618		
June		2,600,795	2,490,407	205,008	1,680	
July		2,678,603	2,308,984	230,691		
August		2,975,864	2,903,410	140,462		
September		3,738,066	3,474,631	138,230		
October		5,136,469	4,937,149	168,968		
November		6,367,024	6,030,065	195,140		
December		6,246,189	5,946,215	132,100		
1898.						
January	600	5,201,895	5,206,673	100,100		
February	100	5,239,506	5,033,039	172,286		
March		5,877,277	5,697,133	228,563		
April		5,655,315	5,494,488	211,069		
May		4,672,042	4,502,213	248,645		
June	275	3,727,856	3,536,857	227,352		
July		3,762,028	3,530,319	147,144		
August		5,444,367	5,178,388	219,146		
September		6,101,434	5,777,500	181,921		
October		8,171,276	7,818,546	207,433		
November		8,219,114	7,953,916	227,192		
December		8,964,073	8,749,534	255,282		
1899.						
January		7,831,516	7,669,585	257,430		
February		7,651,730	7,091,142	272,773		
March		8,002,771	7,817,533	336,510		
April		6,990,161	6,759,008	316,294		
May		6,634,564	6,309,455	374,105		
June		5,366,867	5,049,382	309,508		
Total	1,753	647,609,989	616,352,756	29,442,337	127,057	1,542
On hand June 30, 1899.						787,503
1899. ^a						
July		5,802,768	5,668,111	232,187		
August		7,165,520	6,829,625	352,027		
September		9,004,412	8,548,614	255,409		
October		9,639,198	9,548,318	259,750		
November		11,006,430	10,456,645	254,397		
December		10,635,069	10,187,591	218,148		
Total		53,554,327	51,238,904	1,571,918		

^a The figures for July to December, 1899, have been kindly furnished by the Secretary of the Treasury, in advance of the appearance of the regular report of the Bureau of Internal Revenue.

TABLE V.—*Production and distribution of oleomargarine by districts, etc.—Cont'd.*

Internal revenue districts.	Produced.	With- drawn, tax paid.	With- drawn for export.	Lost or destroyed.	Remaining in factory June 30.
<i>Year ended June 30, 1896—Continued.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Eleventh Ohio.....	2,190,753	2,195,686	.....	.....	3,955
Eighteenth Ohio.....	1,743,535	1,736,266	.....	.....	12,764
First Pennsylvania.....	177,025	4,565	180,650	.....	.....
Total.....	50,853,234	47,741,703	3,106,204	2,430	396,404
<i>Year ended June 30, 1899.</i>					
Colorado.....	.....	.....	.....	.....	.....
Connecticut ^a	7,912,571	5,626,806	2,283,455	.....	68,646
First Illinois.....	38,897,603	38,164,188	452,372	.....	420,305
Sixth Indiana.....	7,086,900	7,033,393	2,500	.....	89,668
Kansas ^b	13,450,004	13,188,496	334,208	.....	92,543
Maryland.....	1,056,432	1,054,337	.....	.....	2,145
Third Massachusetts.....	.....	.....	.....	.....	.....
Sixth Missouri.....	1,867,211	1,848,152	.....	.....	21,177
Nebraska.....	.....	.....	.....	.....	.....
Twenty-eighth New York.....	.....	.....	.....	.....	.....
First New Jersey.....	439,472	410,052	20,500	.....	8,920
Fifth New Jersey.....	101,185	104,400	3,000	.....	.....
Eleventh Ohio.....	9,991,823	9,948,075	.....	.....	62,029
Eighteenth Ohio.....	2,327,881	2,319,329	.....	.....	22,070
First Pennsylvania.....	.....	.....	.....	.....	.....
Total.....	83,141,081	79,702,288	3,006,035	.....	787,503

^aIncluding the State of Rhode Island. No oleomargarine was manufactured in the State of Connecticut.

^bIncluding the Indian Territory and the Territory of Oklahoma, but no oleomargarine was manufactured in either of these Territories.

TABLE VI.—*Quantity of oleomargarine shipped into each State for fiscal year ended June 30, 1899.*

State or Territory.	Pounds.	Per cent of total.	State or Territory.	Pounds.	Per cent of total.
Alabama.....	226,053	.28+	Nebraska.....	1,024,985	1.29-
Alaska.....	18,080	.02+	New Hampshire.....	455,583	.57+
Arkansas.....	380,389	.48-	New Jersey.....	5,875,975	7.37+
Arizona.....	78,767	.10-	New Mexico.....	115,850	.15-
California.....	74,923	.09+	New York.....	222,788	.28-
Colorado.....	1,123,537	1.41-	Nevada.....	625	.00+
Connecticut.....	134,255	.17-	North Carolina.....	110,244	.14-
Delaware.....	40,475	.05+	North Dakota.....	7,710	.01-
District of Columbia.....	816,848	1.02+	Ohio.....	8,830,969	11.08+
Florida.....	590,235	.74+	Oklahoma.....	117,398	.15-
Georgia.....	405,004	.62+	Oregon.....	41,250	.05+
Illinois.....	18,638,921	23.39-	Pennsylvania.....	11,433,341	14.35-
Idaho.....	58,234	.07+	Rhode Island.....	3,594,984	4.51+
Indiana.....	3,923,228	4.92+	South Carolina.....	238,159	.32+
Indian Territory.....	152,278	.19+	South Dakota.....	55,432	.07-
Iowa.....	79,922	.10+	Tennessee.....	714,640	.90-
Kansas.....	1,658,544	2.08+	Texas.....	1,518,264	1.91-
Kentucky.....	1,490,577	1.87+	Utah.....	8,450	.01+
Louisiana.....	1,043,502	1.31-	Vermont.....	2,990	.00+
Maine.....	102,274	.13-	Virginia.....	1,159,400	1.45+
Maryland.....	1,791,950	2.25-	Washington.....	63,345	.08-
Massachusetts.....	2,083,889	2.61+	West Virginia.....	1,206,865	1.51+
Michigan.....	2,002,521	2.63-	Wisconsin.....	714,742	.90-
Minnesota.....	1,343,865	1.69-	Wyoming.....	39,547	.05-
Missouri.....	3,133,313	3.93+	Total.....	79,695,744	100.00
Mississippi.....	104,622	.13+			
Montana.....	446,022	.56-			

TABLE V.—*Production and distribution of oleomargarine by districts, 1888, 1892, 1896, and 1899.*

Internal revenue districts.	Produced.	With- drawn, tax paid.	With- drawn for export.	Lost or destroyed.	Remaining in factory June 30.
<i>Year ended June 30, 1888.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Colorado.....	296,365	364,841			3,148
Connecticut <i>a</i>	6,713,021	6,202,803	396,989	4,357	140,598
First Illinois.....	17,876,127	17,632,148	242,204	5,206	82,694
Sixth Indiana.....	3,935,316	3,928,544	4,521		42,787
Kansas.....	1,848,040	1,855,774			7,818
Maryland.....					
Third Massachusetts.....	657,712	655,390	16,591		7,138
Sixth Missouri.....					
Nebraska.....					
Twenty-eighth New York <i>b</i>	99,677	102,108			
First New Jersey.....					
Fifth New Jersey.....					
Eleventh Ohio.....	142,304	139,914			2,450
Eighteenth Ohio.....	1,358,452	1,357,363			1,462
First Pennsylvania.....	1,428,453	380,340	1,025,893		28,405
Total.....	34,325,527	32,489,165	1,686,198	9,563	315,900
<i>Year ended June 30, 1892.</i>					
Colorado.....	219,958	223,782			3,869
Connecticut <i>c</i>	4,519,734	4,081,689	438,045		
First Illinois.....	31,122,503	30,649,701	385,334		254,166
Sixth Indiana.....	51,291	30,538			20,753
Kansas <i>d</i>	6,745,093	6,631,634	73,721		49,493
Maryland.....					
Third Massachusetts.....					
Sixth Missouri.....	1,113,674	1,111,355			10,827
Nebraska <i>e</i>	1,889,829	1,889,985		112	
Twenty-eighth New York.....					
First New Jersey.....					
Fifth New Jersey.....					
Eleventh Ohio.....	485,582	485,582			
Eighteenth Ohio.....	1,794,224	1,794,320			
First Pennsylvania.....	422,267	16,915	395,682		20,380
Total.....	48,364,155	46,915,501	1,295,782	112	359,488
<i>Year ended June 30, 1896.</i>					
Colorado.....					
Connecticut <i>c</i>	8,644,860	6,396,020	2,236,585		29,840
First Illinois.....	29,172,122	28,591,110	584,876	2,090	238,790
Sixth Indiana.....	621,455	620,017			4,665
Kansas <i>d</i>	5,936,533	5,826,112	99,343	40	71,123
Maryland.....					
Third Massachusetts.....					
Sixth Missouri.....	688,487	700,963			32,907
Nebraska <i>e</i>	1,611,240	1,609,040	1,900	300	
Twenty-eighth New York.....					
First New Jersey.....					
Fifth New Jersey.....	67,224	62,014	2,850		2,360

a Received June 30, 1897, 31,726 pounds from Rhode Island.*b* Ceased production in April, 1888.*c* Including the State of Rhode Island. No oleomargarine was manufactured in the State of Connecticut.*d* Including the Indian Territory and the Territory of Oklahoma, but no oleomargarine was manufactured in either of these Territories.*e* Including the States of North Dakota and South Dakota, but no oleomargarine was manufactured in either of these States.

TABLE VIII.—*Internal-revenue receipts from oleomargarine by districts, 1899.*

Internal revenue districts.	Collections on oleomargarine at 2 cents per pound.	Special taxes of—		
		Manufacturers.	Wholesale dealers.	Retail dealers.
<i>Fiscal year ended June 30, 1898.</i>				
Alabama.....			\$480.00	\$500.00
Arkansas.....			480.00	1,216.00
Colorado <i>a</i>			1,800.00	2,518.00
Connecticut <i>b</i>	\$105,808.24	\$1,800.00	1,160.00	13,148.00
Florida.....			800.00	2,722.00
Georgia.....	1.30		2,560.00	840.00
First Illinois.....	416,706.32	600.00	840.00	36,094.00
Fifth Illinois.....				1,000.00
Eighth Illinois.....				1,270.00
Thirteenth Illinois.....				952.00
Sixth Indiana.....	109,712.62	1,800.00	1,640.00	6,364.00
Seventh Indiana.....				2,774.00
Third Iowa.....				36.00
Fourth Iowa.....				32.00
Kansas <i>c</i>	266,632.28	600.00		4,382.00
Second Kentucky.....				240.00
Fifth Kentucky.....			320.00	3,002.00
Sixth Kentucky.....			480.00	2,124.00
Seventh Kentucky.....				580.00
Eighth Kentucky.....				32.00
Louisiana <i>d</i>			1,520.00	4,614.00
Maryland <i>e</i>	4,952.80	400.00	3,640.00	5,684.00
Massachusetts.....			1,440.00	1,424.00
First Michigan.....			1,832.00	2,440.00
Fourth Michigan.....				716.00
Minnesota.....			240.00	156.00
First Missouri.....			1,260.00	3,094.00
Sixth Missouri.....	19,765.36	600.00		1,686.00
Montana <i>f</i>				28.00
Nebraska <i>g</i>			280.00	2,302.00
New Hampshire <i>h</i>			40.00	368.00
First New Jersey.....			1,320.00	1,712.00
Fifth New Jersey.....	8,104.10	1,200.00	1,760.00	7,398.00
New Mexico <i>i</i>			480.00	324.00
First New York.....				778.00
Second New York.....			780.00	80.00
Third New York.....				108.00
Fourteenth New York.....				54.00
Twenty-eighth New York.....			480.00	54.00
Fourth North Carolina.....				72.00
Fifth North Carolina.....				140.00
First Ohio.....			2,720.00	6,538.00

a Including the State of Wyoming.*b* Including the State of Rhode Island.*c* Including the Indian Territory and the Territory of Oklahoma.*d* Including the State of Mississippi.*e* Including the State of Delaware, District of Columbia, and two counties of Virginia.*f* Including the States of Idaho and Utah.*g* Including the States of North Dakota and South Dakota.*h* Including the States of Maine and Vermont.*i* Including the Territory of Arizona.

TABLE VIII.—*Internal-revenue receipts from oleomargarine by districts, 1898 and 1899—Continued.*

Internal revenue districts.	Collections on oleomargarine at 2 cents per pound.	Special taxes of—			Total.
		Manufacturers.	Wholesale dealers.	Retail dealers.	
Fiscal year ended June 30, 1898—Continued.					
Tenth Ohio	\$3.20		\$2,200.00	\$1,004.00	\$3,207.20
Eleventh Ohio.....	126,969.20			3,880.00	130,849.20
Eighteenth Ohio	48,945.42	\$800.00	760.00	7,902.00	58,207.42
Oregon <i>a</i>				264.00	264.00
First Pennsylvania.....	63.70		1,620.00	2,364.00	4,067.70
Ninth Pennsylvania				126.00	126.00
Twelfth Pennsylvania				572.00	572.00
Twenty-third Pennsylvania.....			2,680.00	7,962.00	10,642.00
South Carolina.....			960.00	570.00	1,530.00
Second Tennessee.....				288.00	288.00
Fifth Tennessee.....				1,400.00	1,400.00
Third Texas.....			2,560.00	1,536.00	4,096.00
Fourth Texas.....			1,140.00	742.00	1,882.00
Second Virginia.....			480.00	3,064.00	3,544.00
Sixth Virginia.....				300.00	300.00
West Virginia.....			960.00	3,960.00	4,920.00
First Wisconsin.....				274.00	274.00
Second Wisconsin.....			2,560.00	280.00	2,840.00
Total.....	1,107,774.54	7,600.00	44,272.00	160,134.00	1,315,780.54
Fiscal year ended June 30, 1899.					
Alabama.....			1,440.00	678.00	2,118.00
Arkansas.....			480.00	1,066.00	1,536.00
Colorado <i>b</i>			2,030.00	3,434.00	5,514.00
Connecticut <i>c</i>	113,808.74	1,800.00	1,680.00	12,172.00	130,460.74
Florida.....			3,060.00	3,316.00	6,376.00
Georgia.....			3,700.00	2,334.00	6,034.00
First Illinois.....	773,708.80	2,950.00	2,344.00	66,908.00	845,911.80
Fifth Illinois.....			1,320.00	2,448.00	3,768.00
Eighth Illinois.....				3,508.00	3,508.00
Thirteenth Illinois.....			600.00	2,272.00	2,872.00
Sixth Indiana.....	142,504.30	1,950.00	2,680.00	8,552.00	155,686.30
Seventh Indiana.....				2,900.00	2,900.00
Third Iowa.....				32.00	32.00
Fourth Iowa.....				88.00	88.00
Kansas <i>d</i>	264,627.64	1,200.00	300.00	7,370.00	273,397.64
Second Kentucky.....				370.00	370.00
Fifth Kentucky.....			960.00	5,080.00	6,040.00
Sixth Kentucky.....				2,108.00	2,108.00
Seventh Kentucky.....				600.00	600.00
Eighth Kentucky.....				64.00	64.00
Louisiana <i>e</i>			5,140.00	5,574.00	10,714.00
Maryland <i>f</i>	21,201.28	600.00	5,280.00	6,186.00	33,267.28
Massachusetts.....			4,640.00	3,602.00	8,242.00

a Including the State of Washington and the Territory of Alaska.*b* Including the State of Wyoming.*c* Including the State of Rhode Island.*d* Including the Indian Territory and the Territory of Oklahoma.*e* Including the State of Mississippi.*f* Including the State of Delaware, District of Columbia, and two counties of Virginia.

TABLE VIII.—*Internal-revenue receipts from oleomargarine by districts, 1898 and 1899—Continued.*

Internal revenue districts.	Collections on oleomargarine at 2 cents per pound.	Special taxes of—			Total.
		Manufac- turers.	Wholesale dealers.	Retail dealers.	
Fiscal year ended June 30, 1899— Continued.					
First Michigan				5,026.00	5,026.00
Fourth Michigan			1,920.00	910.00	2,830.00
Minnesota			3,000.00	776.00	4,376.00
First Missouri			480.00	6,592.00	7,072.00
Sixth Missouri	37,335.00	600.00	240.00	1,944.00	40,119.00
Montana <i>a</i>				104.00	104.00
Nebraska <i>b</i>			480.00	4,094.00	4,574.00
New Hampshire <i>c</i>			3,720.00	1,048.00	4,768.00
First New Jersey	8,227.44	600.00		3,024.00	12,691.44
Fifth New Jersey	2,056.20		2,520.00	9,738.00	14,314.20
New Mexico <i>d</i>			480.00	674.00	1,154.00
First New York				380.00	380.00
Second New York				48.00	48.00
Third New York	22.00			186.00	208.00
Fourth North Carolina				218.00	218.00
Fifth North Carolina				212.00	212.00
First Ohio			1,920.00	9,586.00	11,506.00
Tenth Ohio			100.00	4,832.00	4,932.00
Eleventh Ohio	199,846.22	600.00		12,830.00	213,276.22
Eighteenth Ohio	46,573.94	1,200.00	1,440.00	12,752.00	61,965.94
Oregon <i>e</i>			240.00	516.00	756.00
First Pennsylvania			3,120.00	4,058.00	7,178.00
Ninth Pennsylvania				360.00	360.00
Twelfth Pennsylvania			320.00	1,482.00	1,802.00
Twenty-third Pennsylvania			3,500.00	19,112.00	22,612.00
South Carolina			900.00	832.00	1,732.00
Second Tennessee				732.00	732.00
Fifth Tennessee			1,480.00	2,806.00	4,286.00
Third Texas			4,280.00	3,936.00	8,216.00
Fourth Texas			1,720.00	1,038.00	2,758.00
Second Virginia			480.00	4,292.00	4,772.00
Sixth Virginia				678.00	678.00
West Virginia			1,440.00	6,138.00	7,578.00
First Wisconsin				366.00	366.00
Second Wisconsin			880.00	260.00	1,140.00
Total	1,609,912.56	11,500.00	71,884.00	263,322.00	1,956,618.56

a Including the State of Idaho and Utah.*b* Including the States of North Dakota and South Dakota.*c* Including the States of Maine and Vermont.*d* Including the Territory of Arizona.*e* Including the State of Washington and the Territory of Alaska.

TABLE IX.—*Internal revenue receipts from oleomargarine, all sources, 1887 to 1899.*

Fiscal year ended June 30—	General tax 2 cents per pound.	Special taxes of—			Total.	Percent- age of total in- ternal- revenue receipts.
		Manufac- turers, \$600.	Wholesalers, \$400.	Retailers, \$48.		
1887.....	\$435,924.04	\$31,700.00	\$101,400.00	\$154,924.00	\$723,948.04	0.61—
1888.....	653,355.10	17,150.00	70,376.24	123,258.54	864,139.88	.70—
1889.....	677,302.40	12,400.00	73,914.00	130,631.51	894,247.91	.68+
1890.....	619,205.72	11,700.00	55,318.00	100,068.00	786,291.72	.55+
1891.....	871,488.44	6,950.00	53,192.00	146,293.70	1,077,924.14	.74—
1892.....	945,675.00	10,400.00	103,036.00	204,215.00	1,259,326.00	.82+
1893.....	1,304,317.50	15,350.00	115,044.00	238,332.00	1,673,043.50	1.04—
1894.....	1,328,558.00	11,250.00	107,394.00	276,277.90	1,723,479.90	1.17+
1895.....	1,065,293.40	8,950.00	98,784.00	236,183.78	1,409,211.18	.98+
1896.....	952,475.46	15,725.00	72,264.00	178,968.00	1,219,432.46	.83+
1897.....	850,691.18	7,200.00	45,900.00	130,338.42	1,034,129.60	.71—
1898.....	1,107,774.54	7,000.00	44,272.00	156,134.00	1,315,180.54	.77
1899.....	1,009,912.56	11,500.00	71,884.00	263,322.00	1,356,618.56	.72—
Total.....	12,418,973.34	167,875.00	1,010,378.24	2,338,946.85	15,942,173.43	.....

TABLE X.—*Exports of oleomargarine by customs districts, 1894, 1898, and 1899.*

Customs districts.	Fiscal year ended June 30—		
	1894.	1898.	1899.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Baltimore, Md.....	218,400	1,230,466	1,512,462
Bangor, Me.....		25	
Barnstable, Mass.....	300		
Boston and Charlestown, Mass.....	36,000	153,643	125,247
Newport News, Va.....			27,963
New York, N. Y.....	3,517,891	2,295,054	3,001,327
Philadelphia, Pa.....	17,522	171,775	803,061
Portland, Me.....			1,070
Providence, R. I.....	1,046		
Savannah, Ga.....		1,874	100
Corpus Christi, Tex.....	112	1,800	
Key West, Fla.....			1,595
Mobile, Ala.....	630	3,656	9,135
New Orleans, La.....	14,164	7,400	21,313
Paso del Norte, Tex.....	740		
Tampa, Fla.....			120
Saluria, Tex.....	8,901	3,642	6,714
Arizona.....	1,250	3,005	
Puget Sound, Wash.....	3,820	23,736	32,361
San Francisco, Cal.....	37,354	142,459	177,634
Willamette, Oreg.....			540
Detroit, Mich.....		280,800	28,640
Duluth, Minn.....		120	
Huron, Mich.....	40,010		
North and South Dakota.....	200		
Total.....	3,888,950	4,328,536	5,540,322

TABLE XI.—*Monthly exports of oleomargarine, quantities and values, 1898 and 1899.*

Month.	Fiscal year ended June 30—			
	1898.		1899.	
	Quantity.	Value.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>	<i>Pounds.</i>	<i>Dollars.</i>
July.....	178,263	16,078	696,381	61,500
August.....	641,142	59,605	532,934	47,27
September.....	263,527	24,370	748,774	65,26
October.....	153,340	14,806	472,501	41,67
November.....	204,080	20,417	419,030	40,23
December.....	334,331	28,396	346,148	31,03
January.....	161,445	16,215	305,247	27,75
February.....	264,086	23,107	425,600	40,50
March.....	339,441	31,853	353,940	37,51
April.....	434,069	35,592	370,750	36,90
May.....	952,340	76,123	445,406	41,04
June.....	402,492	39,735	433,411	41,85
Total.....	4,328,536	386,297	5,549,322	50,76

TABLE XII.—*Quantities and values of exports of oleomargarine and oleo oil, 1876 to 1883.*

Fiscal year ended June 30—	Quantity.	Value.	Average per pound.
	<i>Pounds.</i>	<i>Dollars.</i>	<i>Cents.</i>
1876.....		70,485	.....
1877.....		595,335	.....
1878.....	1,698,401	203,280	11.4
1879.....	12,687,318	1,394,068	11.0
1880.....	19,844,256	2,582,640	13.0
1881.....	26,327,676	3,815,590	14.5
1882:			
Oleomargarine.....	2,157,446	312,854	14.5
Oleo oil.....	19,714,838	2,766,038	13.7
1883:			
Oleomargarine.....	1,950,301	271,699	13.9
Oleo oil.....	29,031,064	4,273,220	14.7

TABLE XIII.—Exports of oleo oil, by customs districts, fiscal years 1894, 1898, and 1899.

Customs districts.	1894.	1898.	1899.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Baltimore, Md.	23,544,161	42,367,301	36,736,460
Bangor, Me.			1,296
Boston and Charlestown, Mass.	3,811,253	4,502,533	4,450,139
New York, N. Y.	93,265,298	80,355,116	91,623,920
Philadelphia, Pa.	2,227,788	4,189,571	7,482,806
Portland and Falmouth, Me.		706,121	
New Orleans, La.		93,413	
San Francisco, Cal.		750	
Detroit, Mich.	150,500	193,950	47,850
Harro, Mich.	296,900	150,522	39,080
Total.	123,295,895	132,579,277	142,390,492

TABLE XIV.—Monthly exports of oleo oil, quantities and values, fiscal years 1898 and 1899.

Month.	1898.		1899.	
	Quantity.	Value.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>	<i>Pounds.</i>	<i>Dollars.</i>
July.	11,350,543	637,624	14,746,933	848,827
August.	8,966,899	502,451	11,000,148	667,517
September.	12,500,810	804,781	10,668,719	635,072
October.	9,778,352	613,018	11,676,227	731,878
November.	9,506,635	559,496	8,287,594	512,055
December.	11,645,992	691,777	10,762,801	662,050
January.	8,582,788	498,704	9,012,969	574,707
February.	8,414,165	480,579	9,399,349	679,277
March.	13,971,409	834,325	13,172,038	942,918
April.	12,364,311	739,964	12,490,677	856,441
May.	12,911,263	785,200	13,083,108	908,272
June.	12,517,110	756,524	17,439,929	1,164,630
Total.	132,579,277	7,904,413	142,390,492	9,183,659

TABLE XV.—Quantities of exports of oleomar-

Countries.	1884.	1885.	1886.	1887.	1888.	1889.	
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	
Azores, and Madeira Islands.....							1
Belgium.....	1,520						2
Denmark.....							3
France.....	a 732	a 2,073					4
Germany.....	30,700	805	1,602			25,072	5
Gibraltar.....							6
Italy.....							7
Netherlands.....		10,342	171,826				8
Portugal.....		1,450		1,406	8,598	3,080	9
Spain.....							10
Sweden and Norway.....						20,351	11
United Kingdom.....	421,316	104,238	134,276	17,900	56,896	79,410	12
Bermuda.....							13
British Honduras.....			9,815	2,150	8,775		14
Dominion of Canada:							
Nova Scotia, New Brunswick,							
etc.....	88,696	4,512	9,572	15,260		3,040	15
Quebec, Ontario, etc.....	1,000		28,992		48,000	112,000	16
British Columbia.....	1,280						17
Newfoundland and Labrador.....	900,927	627,053	554,842	478,142	183,266	278,041	18
Central American States.....	300	400					
Costa Rica.....							19
Guatemala.....			820			1,000	20
Honduras.....			90		2,325		21
Nicaragua.....						1,050	22
Salvador.....							23
Mexico.....	2,071	672	1,303				24
Miquelon, Langley, etc.....				77,719	71,500	80,264	25
West Indies:							
British.....	39,761	8,202	9,216	161,693	716,830	732,311	26
Danish.....	1,884	281	1,233	13,227	72,738	96,200	27
Dutch.....						1,006	28
French.....				37,875	103,837	241,494	29
Haiti.....				50			30
Santo Domingo.....			100			6,700	31
Spanish—Cuba.....	372		1,800	2,600	88,500	128,305	32
Porto Rico.....			180	50	12,600	82,429	33
Argentina.....							34
Brazil.....				623	2,200		35
Chile.....							36
Colombia.....	29,216	900	2,200		22,072	60,710	37
Ecuador.....							38
Guanas:							
British.....				25,600	328,940	215,040	39
Dutch.....						9,500	40
French.....	927						41
Peru.....				50			42
Uruguay.....							43
Venezuela.....					200	5,850	44
China.....							45
East Indies:							
British.....							46
Dutch.....		900					47
Hongkong.....							48

a French possessions.

given, by countries, fiscal years 1884 to 1899.

	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1				300	600				
2		27,220	45,640	76,867	60,180	71,180	50,400	43,230	44,680
3								6,278	27,940
4			560					1,240	
5	98,600		31,030	220,860	1,563,200	2,382,026	1,300,336	1,616,164	1,905,560
6					400				
7					100			900	20,922
8	124,700	553,718	174,930		4,130,363			973	
9			2,140	159,308	3,650	1,950	2,150	2,400	4,600
10							1,000		
11	223,730		78,658	46,743	1,300	313,338			40,896
12	165,477	5,448	6,928	12,192	57,295	1,193,259	230,447	264,595	317,410
13			21,588	22,021	30,162	31,073	28,348	20,428	24,760
14		1,060		5,748	614	470	113	420	1,450
15									
16	118,161	225,029	27,800	99,950	400	100		25	
17	102,350	201,280	17,500	57,333	40,010		12,100	120	
18					840			250	18,450
19	119,147	58,248	312,710	99,874	69,200		71,200	5,200	
20				2,096	13,300	700	1,340	1,730	4,000
21				100			300	60	
22		200	300	600	170	180		3,630	1,858
23			1,272	1,563	1,860	2,373	2,454	820	2,580
24							3,600		
25		600	1,350	1,452	14,007	21,655	11,215	6,414	9,017
26	80,127	52,070	32,636	42,170	7,400	13,430	28,850	12,966	11,750
27									
28	724,027	395,518	697,137	1,494,195	1,620,224	1,259,090	1,386,563	1,332,133	1,167,295
29	57,228	23,075	6,170	73,480	108,020	97,550	102,890	95,400	103,975
30			600	6,100	11,980	25,163	14,062	5,651	9,780
31	249,008	222,508	192,345	691,448	834,458	997,276	887,870	1,048,355	403,380
32	8,000		2,200	6,150	62,080	78,327	60,204	41,830	38,750
33	2,365			2,020	3,900	2,725			1,120
34	56,300	58,020	66,397	5,624	4,300	4,620		250	157,706
35	68,010	59,100	20,700	43,670	76,534	110,515	18,440		204,831
36						400		224	400
37	5,600	1,000		1,984	5,894	29,060	200	20,300	2,732
38	1,440		1,000	1,243		1,300			
39	74,165	3,000	1,736	32,800	71,815	89,882	87,100	86,896	123,224
40		204		1,506	543	5,850		93,896	
41									
42	163,596	101,930	44,000	238,271	363,748	197,100	184,900	187,460	89,951
43	2,000	15,500	47,000	46,500	40,900	80,200	52,320	55,830	45,000
44							1,100	20,700	19,100
45					100	3,600	50	400	
46								390	200
47	400	400	100	21,980	96,379	32,400	37,980	16,700	4,000
48		185			1,700	13,576	1,490	4,290	8,130
49									11,860
50						9,650	110	6,444	14,210
51								825	1,200
52									
53					7,700	500	500	2,000	133

TABLE XV.—Quantities of exports of oleomargarine,

Countries.	1884.	1885.	1886.	1887.	1888.	1889.	
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
Japan							49
British Australasia							50
Hawaiian Islands							51
British Africa	6,000					200	52
Liberia							53
Canary Islands							54
French Africa					2,000		55
Madagascar							56
Portuguese Africa							57
All other Africa							58
Other countries							59
Total	1,537,682	761,938	928,053	834,574	1,729,327	2,192,047	

TABLE XVI.—Values of exports of oleomargarine,

Countries.	1884.	1885.	1886.	1887.	1888.	1889.	
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	
Azores, and Madeira Islands							1
Belgium	175						2
Denmark							3
France	a 144	a 383					4
Germany	2,605	145	169			2,575	5
Gibraltar							6
Italy							7
Netherlands		1,242	18,045				8
Portugal		210		184	1,002	339	9
Spain							10
Sweden and Norway						2,081	11
United Kingdom	47,874	12,482	14,060	1,850	5,504	8,533	12
Bermuda							13
British Honduras			1,770	280	1,189		14
Dominion of Canada:							
Nova Scotia, New Brunswick,							
etc	9,762	654	1,056	1,323		350	15
Quebec, Ontario, etc.	323		3,479		7,680	16,390	16
British Columbia	260						17
Newfoundland and Labrador	96,890	76,079	52,674	42,138	20,269	30,358	18
Central American States	74	40					
Costa Rica							19
Guatemala			162			105	20
Honduras			15		279		21
Nicaragua						127	22
Salvador							23
Mexico	574	133	281				24
Miquelon, Langley, etc.				7,494	7,977	9,090	25
West Indies:							
British	6,029	1,063	929	23,763	89,105	84,305	26
Danish	256	44	157	1,919	8,943	10,906	27
Dutch						140	28
French				6,046	13,849	27,668	29
Haiti				8			30

a French possessions.

by countries, fiscal years 1884 to 1899.—Continued.

	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1					6,600	16,520	20,909	32,653	31,836	19,185
2	850		200		300		700	336	2,420	
3					32,350	37,150	34,000	47,750	138,350	151,400
4	200	500	550	8,552	10,500	61,350	16,800	161,167	101,110	150,500
5						100				
6								1,000		
7								980		
8								800		
9								50		
10								4,912	160	
11										26,100
12	2,335,926	1,980,743	1,610,837	3,479,322	3,898,950	10,100,807	6,063,699	4,864,351	4,328,536	5,549,322

by countries, fiscal years 1884 to 1899.

	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
1					42	50				
2			3,158	5,266	10,433	6,889	7,738	5,328	4,568	4,678
3									753	2,560
4				50					124	
5	14,845			4,337	19,560	123,363	197,548	112,466	119,108	156,770
6						40				
7						9			110	2,900
8	17,465	83,058		21,000		370,576			129	
9			225	16,045	436	195	215		240	514
10								100		
11	23,583		9,150	5,935		143	37,092			2,863
12	15,391	544	878	1,518	7,423	115,924	24,730	26,157	30,005	24,630
13			3,079	2,882	4,357	4,092	3,311	2,299	2,752	3,521
14		116		887	89	66	14		38	146
15										
16	21,477	33,330	4,170	13,993	49	16			2	
17	21,779	27,641	2,625	7,360	5,551			1,120	12	
18					120				34	2,200
19	11,984	6,909	39,610	11,855	10,402		7,920	505		
20				436	1,400	108	125	169	472	1,759
21				18			45	8		
22		22	39	94	33	27			471	204
23			139	309	250	334	282	84	273	405
24							402			
25		66	151	272	1,948	2,585	1,232	701	961	731
26	3,690	5,365	3,292	4,174	779	1,324	2,696	1,104	941	594
27	82,272	44,291	85,607	175,029	194,276	147,493	146,660	132,072	113,402	148,007
28	6,620	2,880	787	9,371	14,193	11,386	11,131	9,134	9,711	10,135
29			75	937	1,572	2,702	1,429	525	892	1,897
30	28,052	23,542	20,730	82,998	106,507	121,505	98,708	109,467	39,451	21,746
31	920		234	1,043	7,806	9,907	6,369	4,259	3,856	2,700

TABLE XVI.—*Values of exports of oleomargarine.*

Countries.	1884.	1885.	1886.	1887.	1888.	1889.	
West Indies—Continued.	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	
Santo Domingo			12			707	21
Spanish—Cuba	55		182	350	10,884	13,868	22
Porto Rico			20	6	1,627	8,860	23
Argentina							24
Brazil				111	300		25
Chile							26
Colombia	5,410	169	352		2,533	6,614	27
Ecuador							28
Guianas:							
British				3,370	41,248	25,614	29
Dutch						1,230	30
French	128						31
Peru				6			32
Uruguay							33
Venezuela					24	660	34
China							35
East Indies:							
British							36
Dutch		135					37
Hongkong							38
Japan							39
British Australasia							40
Hawaiian Islands							41
British Africa	560					26	42
Liberia							43
Canary Islands							44
French Africa					290		45
Madagascar							46
Portuguese Africa							47
All other Africa							48
Other countries							49
Total	171,119	92,779	93,363	88,648	212,634	250,095	
Average per pound, cents....	11.1	12.2	10.1	10.7	12.3	11.5	

by countries, fiscal years 1884 to 1899—Continued.

	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
31	241			437	540	383				112
32	7,113	6,611	7,520	748	538	613			26	19,058
33	8,062	6,648	2,448	5,458	10,182	13,540	1,739			22,008
34						62			27	48
35	800	125		228	813	4,144	22	1,714	371	
36	158		145	187		160				
37	8,236	395	207	4,377	8,573	9,539	8,805	7,513		11,225
38		27		185	83	870			8,400	
39	18,910	11,624	5,541	29,885	43,398	12,856	21,013	21,972	9,385	18,877
40	215	1,751	5,551	5,247	4,649	9,011	4,975	4,758	3,985	4,939
41							120	2,620	1,822	
42					12	400	5	40		
43									43	25
44	52	42	15	2,883	12,021	3,719	4,006	1,441	240	4
45		22			262	1,863	100	250	1,270	1,630
46						1,333	11	882	1,053	5,795
47								102	100	
48						783	50	50	330	14
49					976	1,758	2,628	3,166	3,217	1,970
50	153		22		45		70	51	378	
51					4,322	4,570	3,750	5,281	15,053	15,471
52	35	75	100	936	1,354	8,111	2,057	19,763	11,441	15,225
53						15				
54								100		
55								101		
56								60		
57								6		
58								488	12	
59										2,785
	207,264	255,624	195,587	416,396	475,003	922,434	587,280	172,856	386,297	500,703
	11.4	12.8	12.1	12.0	12.1	9.8	9.7	9.7	8.9	9.2

TABLE XVII.—Quantities of exports of oleo

Countries.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	
Austria-Hungary								1
Belgium	2,864,263	2,328,777	728,080	710,221	549,086	339,878	1,081,008	2
Denmark	22,644	2,211	5,854	93,800	175,705	714,606	466,237	3
France			3,900	851,281	544,924	498,495	1,142,474	4
Germany	96,551	8,506	976,734	4,859,259	5,680,407	5,387,459	10,561,064	5
Italy					59,500	130,163		6
Netherlands	33,173,819	34,012,807	25,562,417	37,824,789	21,217,682	19,879,425	52,236,964	7
Portugal								8
Spain								9
Sweden and Norway			27,181	18,960			270,500	10
United Kingdom	1,545,947	715,383	372,411	1,006,912	1,674,237	1,003,549	2,432,951	11
Dominion of Canada:								
Nova Scotia, New Brunswick, etc.								12
Quebec, Ontario, etc.								13
Newfoundland and Labrador.	60,566	39,806	54,045	161,450	180,252	74,957		14
Central American States: Costa Rica.	475	50						15
Mexico	6,300	10,806			2,522	4,600		16
Miquelon, Langley, etc.			706	2,100				17
West Indies:								
British					51,200	18,397		18
Danish	4,230							19
French				700				20
Cuba				350				21
Argentina						41,557		22
Brazil								23
Columbia	365							24
Guianas:								
British						9,000		25
Dutch								26
Venezuela		1,811			2,000			27
British Australasia						448		28
Hawaiian Islands								29
Other countries								30
Total	37,785,159	37,120,217	27,720,885	45,712,985	30,146,595	28,162,534	68,218,068	

oil, by countries, fiscal years 1884 to 1899.

	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1							110,210		946,500
2	537,409	553,023	987,560	140,613	2,757,665	1,306,447	1,785,285	1,126,237	2,065,814
3	2,792,531	4,247,075	4,316,817	3,080,723	2,237,856	2,942,685	2,614,669	3,146,372	3,657,257
4	60,823	30,296	2,394,980	1,424,055		158,800	93,600	651,515	142,872
5	12,733,532	18,584,069	23,545,712	28,996,007	21,202,754	23,021,053	23,578,010	29,973,923	28,647,410
6		34,000						6,041	82,252
7	36,716,497	58,952,145	74,221,305	74,248,165	42,000,300	61,575,305	70,988,741	81,451,126	86,452,770
8			144,975	34,930					
9				2,150					
10	1,800,834	1,884,279	1,920,899	3,006,833	2,356,770	4,002,473	5,625,418	6,552,600	12,054,375
11	2,400,200	6,629,411	5,502,077	9,520,217	6,809,688	8,701,258	7,306,744	8,846,727	7,303,110
12		20,963				5,125	73,267	313,311	155,265
13	477,190	304,610	3,995	296,900	24,000	798,958	418,109	30,125	40,780
14	11,957	326,737	901,043	1,584,642	700,746	672,066	787,484	480,071	697,709
15						600			
16						1,486			
17		14,100							
18									
19							29,600		
20									2,000
21									
22							500		
23									
24									
25						500		389	
26		1,000							
27							1,455		
28								750	
29									52,378
30	80,231,635	91,581,703	113,939,363	123,295,895	78,008,878	103,276,756	113,506,152	132,579,277	142,390,492

TABLE XVIII.—*Values of exports of oleo*

Countries.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	
Austria-Hungary								1
Belgium	358,798	270,631	68,004	66,917	59,289	37,931	102,509	2
Denmark	4,200	318	647	8,748	18,393	61,059	47,029	3
France			375	81,567	56,218	48,518	110,141	4
Germany	11,866	1,065	100,321	476,620	589,113	502,777	1,054,371	5
Italy					4,760	12,000		6
Netherlands	4,127,827	4,000,414	2,737,545	3,927,943	2,907,627	1,896,438	4,897,674	7
Portugal								8
Spain								9
Sweden and Norway			2,961	2,137			26,147	10
United Kingdom	161,156	82,836	39,908	98,604	170,525	100,890	238,387	11
Dominion of Canada:								
Nova Scotia, New Brunswick, etc.								12
Quebec, Ontario, etc.								13
Newfoundland and Labrador.	6,159	2,611	5,113	13,226	17,508	7,647		14
Central American States: Costa Rica.	84	12						15
Mexico	605	752			245	430		16
Miquelon, Langley, etc.			85	220				17
West Indies:								
British					6,212	2,155		18
Danish	520							19
French				105				20
Cuba				44				21
Argentina						3,637		22
Brazil								23
Columbia	28							24
Guianas:								
British						970		25
Dutch								26
Venezuela		164			235			27
British Australasia						40		28
Hawaiian Islands								29
Other countries								30
Total	4,671,243	4,358,853	2,954,954	4,676,151	3,230,123	2,654,492	6,476,258	
Average per pound—cents	12.4	11.7	10.7	10.2	10.7	9.5	9.5	

oil, by countries, fiscal years 1884 to 1899.

	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
1							5,500		55,935
2	54,663	53,047	103,267	14,500	250,778	107,816	102,352	72,188	136,054
3	268,664	417,751	422,195	394,315	210,056	228,663	151,840	178,175	240,511
4	67,652	3,030	219,209	134,306		10,841	9,666	38,764	9,335
5	1,253,556	1,635,577	2,367,062	2,837,846	1,839,310	1,575,906	1,285,616	1,702,672	1,923,259
6		3,400						420	4,740
7	5,759,672	5,686,497	7,272,618	7,124,442	3,907,712	5,056,488	4,375,564	4,878,184	5,514,523
8			13,746	3,740					
9				210					
10	172,016	175,591	168,272	289,666	214,836	348,462	295,319	372,912	788,862
11	238,449	669,819	553,080	966,187	623,145	664,943	450,015	521,420	452,239
12		2,747				347	3,637	17,544	8,309
13	43,146	30,461	528	29,721	2,160	51,377	22,866	1,587	2,252
14	1,312	32,309	86,373	150,900	59,021	42,857	37,596	30,425	44,767
15						66			
16						80			
17		1,600							
18									
19							2,469		
20									
21									109
22									
23							51		
24									
25						30		3	
26		100							
27							67		
28									
29								90	
30									2,674
	7,859,730	9,011,889	11,207,250	11,912,842	7,107,318	8,087,905	6,742,061	7,904,413	9,183,659
	9.8	9.8	9.8	9.7	9.1	7.8	5.9	5.9	6.4

TABLE XIX.—*Production and distribution of filled cheese and total revenue receipts therefrom, 1897 to 1899.*

Fiscal year ended June 30—	Quantity produced.	Quantity withdrawn, tax-paid.		Received, all sources.
		For domestic use.	For export.	
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Dollars.</i>
1897 (from Sept. 4, 1896).....	1,063,067	1,475,954	187,113	18,992.38
1898.....	1,402,861	1,383,963	13,868	16,318.55
1899.....	1,688,650		1,688,650	18,086.42
Total.....	4,754,578	2,859,917	1,894,631	53,397.35

TABLE XX.—*Average monthly production and distribution of filled cheese, 1897 to 1899.*

Fiscal year ended June 30—	Quantity produced.	Quantity withdrawn, tax-paid.	
		For domestic use.	For export.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1897 (from Sept. 4, 1896).....	166,306	147,595	18,711
1898.....	116,905	115,333	1,572
1899.....	140,721		140,721

TABLE XXI.—*Monthly production and distribution of filled cheese, September, 1896, to June, 1899.*

Year and month.	Quantity produced.	Quantity withdrawn, tax paid.	
		For domestic use.	For export.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1896.			
September.....	31,342		31,342
October.....	61,900	54,487	7,413
November.....	20,428	13,329	6,899
December.....	38,301	23,862	14,439
1897.			
January.....	136,184	129,501	6,683
February.....	266,810	247,599	19,211
March.....	371,569	344,369	27,200
April.....	305,346	287,136	18,210
May.....	188,546	176,103	12,443
June.....	242,641	194,368	48,273
July.....			
August.....			
September.....	106,045	106,045	
October.....	165,007	162,221	2,786
November.....	151,885	151,201	684
December.....	222,022	219,238	2,784
1898.			
January.....	230,084	228,054	2,030
February.....	195,029	192,307	2,722
March.....	188,453	188,453	
April.....	143,406	136,474	6,932

TABLE XXI.—*Monthly production and distribution of filled cheese, September, 1896, to June, 1899—Continued.*

Year and month.	Quantity produced.	Quantity withdrawn, tax paid.	
		For domestic use.	For export.
1898.	Pounds.	Pounds.	Pounds.
May.....			
June.....	240		240
July.....			
August.....			
September.....			
October.....			
November.....			
December.....	71,856		71,856
1899.			
January.....	223,830		223,830
February.....	231,635		231,635
March.....	317,112		317,112
April.....	234,025		234,025
May.....	275,127		275,127
June.....	335,065		335,065
Total.....	4,754,578	2,859,947	1,894,631

TABLE XXII.—*Months of largest and smallest production of filled cheese and amounts produced, 1897 to 1899.*

Year ended June 30—	Largest production.		Smallest production.	
		Pounds.		Pounds.
1897.....	March, 1897.....	305,346	November, 1896.....	20,428
1898.....	January, 1898.....	230,684	July and August, 1897, and May, 1898.	0
1899.....	June, 1899.....	335,065	July to November, 1898...	0

TABLE XXIII.—*Number of manufacturers, wholesalers, and retailers of filled cheese in each State and Territory, during the fiscal years 1897 to 1899.*

State or Territory.	1897.			1898.			1899.		
	Manu- fac- turers.	Whole- salers.	Retail- ers.	Manu- fac- turers.	Whole- salers.	Retail- ers.	Manu- fac- turers.	Whole- salers.	Retail- ers.
Illinois.....	7		4	7		3	5		
Indiana.....			3						
Louisiana.....			29			14			
Maryland.....		1	19			1			
Missouri.....			2						
New Jersey.....			2			1			
Virginia.....			2						
West Virginia.....			1						
Total.....	7	1	62	7		19	5		
Number of States and Territories in which lo- cated.....	1	1	8	1		4	1		

TABLE XXIV.—*Internal revenue receipts from filled cheese, all sources, fiscal years 1897 to 1899.*

Year ended June 30—	General tax (1 cent per pound).	Special taxes of—			Total.	Percent- age of total in- ternal revenue receipts.
		Manufac- turers (\$400).	Wholesale dealers (\$250).	Retail dealers (\$12).		
1897.....	\$16,661.37	\$1,566.68	\$206.33	\$550.00	\$18,982.38	0.013—
1898.....	14,129.23	2,233.32		156.00	16,518.55	.010—
1899.....	16,886.41	1,200.01		12.00	18,086.42	.007—

TABLE XXV.—*Internal revenue receipts from filled cheese, by districts, fiscal years 1897 to 1899.*

Internal revenue districts.	Collec- tions on filled cheese at 1 cent per pound.	Special taxes of—			Total.
		Manufac- turers.	Wholesale dealers.	Retail dealers.	
Year ended June 30, 1897.					
First Illinois.....	\$16,575.21	\$1,566.68		\$39.00	\$18,180.89
Sixth Indiana.....				20.00	20.00
Louisiana <i>a</i>	17.08			240.00	257.08
Maryland <i>b</i>	24.28		\$208.33	106.00	427.61
Minnesota.....				10.00	10.00
Sixth Missouri.....	19.75			20.00	39.75
First New Jersey.....				3.00	3.00
Fifth New Jersey.....				6.00	6.00
Ninth Pennsylvania.....				10.00	10.00
Second Virginia.....				7.00	7.00
West Virginia.....				6.00	6.00
First Wisconsin.....	25.05				25.05
Total.....	16,661.37	1,566.68	208.33	556.00	18,992.38
Year ended June 30, 1898.					
First Illinois.....	14,129.23	2,233.32		21.00	16,383.55
Louisiana <i>a</i>				111.00	111.00
Maryland <i>b</i>				12.00	12.00
Fifth New Jersey.....				12.00	12.00
Total.....	14,129.23	2,233.32		156.00	16,518.55
Year ended June 30, 1899.					
First Illinois.....	16,886.41	1,200.01			18,086.42
Maryland <i>b</i>				12.00	12.00
Total.....	16,886.41	1,200.01		12.00	18,086.42

a Including the State of Mississippi.*b* Including the State of Delaware, District of Columbia, and two counties of Virginia.

FOREIGN MARKETS FOR EGGS AND POULTRY.

[Incidental to the experimental exports of butter and cheese made by this Department during the years 1898 and 1899, and reported upon elsewhere in this volume, a few trial shipments of eggs were made to England, and the special agent who visited several places in Great Britain, Germany, and France investigated markets for poultry and eggs and reported upon the same. Portions of these reports which may be of public interest have been condensed and arranged, and, together with the results of the egg exports, they are given in the following pages.]

REPORT ON TRIAL SHIPMENTS OF EGGS TO ENGLAND.

By HENRY E. ALVORD, C. E.,

Chief of Dairy Division, Bureau of Animal Industry.

For the purpose of testing the merits of American eggs in English markets, three trial shipments were made to Manchester during the years 1898 and 1899 in connection with the experiments in exporting butter, then in progress under the direction of the Dairy Division of this Bureau. Orders for eggs for this purpose were placed with three firms doing large business in this line, in different parts of the country, but only one of these was able to supply the eggs at the time required. Consequently all the eggs used in these trials were furnished by a leading firm of Nevada, Iowa.

For the first shipment by the Department, three lots of fresh eggs (240 dozen, or 10 cases in each lot) were selected and packed in Iowa in April, 1898. These were sorted carefully, so that one lot (Lot B) contained only dark-brown eggs, one lot (Lot W) only pure white eggs, and one lot (Lot M) was mixed as to color, as usual in our domestic wholesale markets. Then, in order to test the risk of breakage in transit, half of each lot was packed in ordinary egg cases holding 30 dozen each, and the other half in patent cases with mineral wool packing and holding only 18 dozen each. The latter mode of packing was also claimed to add materially to the keeping quality of the eggs.

These eggs left Iowa April 23, reached Philadelphia the 29th, and were exported in the refrigerator of the steamship *Waesland* of the International Navigation Company, sailing April 30, and arriving at Liverpool May 13 and at Manchester the next day. The eggs were placed for sale in the hands of Messrs. Dowdall Brothers, of Manchester, who have long conducted a large business in this line. A special agent of the Department was present and reported the facts in full. At this market 10 dozen is the ordinary unit for quotation and trade in eggs, this quantity being known as a "long hundred." The standard weight of 120 eggs is considered to be 15 pounds.

The first test and comparison of our American eggs related to weight, and resulted as follows:

		Pounds.	Ounces.
United States eggs, Lot B.....	per 120...	14	12
United States eggs, Lot W.....	do....	15	0
United States eggs, Lot M.....	do....	15	4
Irish, reselected.....	do....	15	8
Irish, special packing.....	do....	15	0
Hungarian, reselected.....	do....	14	8

The eggs were at once placed on sale and Messrs. Dowdall reported the market in advance as follows:

		s.	d.
Irish, reselected.....	per 120..	6	2
Best Irish.....	do....	5	10
Ordinary Irish.....	do....	5	6
Hungarian.....	do....	5	0
United States, selected.....	do....	6	0

The final report on our export lot showed sales to have been made as follows: Eight cases at 5s. 6d. per 120, 8 cases at 6s. per 120, 13 cases at 6s. 1d. per 120, 4 cases at 6s. 6d. per 120. The average price was thus 6s. 2½d. per 120 eggs, while the highest market rate for the British domestic product was 6s. 2d., and some of ours sold as high as 6s. 6d. The average may be regarded as 15 cents per dozen. The selected brown and white eggs cost 12 cents per dozen f. o. b. in Iowa and the mixed lot 10 cents; average, 11½ cents. The cost of export and sale included the following items: Freight, Iowa to New York, \$12, or 1.66 cents per dozen; ocean freight to Liverpool, \$18, or 2.5 cents per dozen; charges for entry, landing, customs, attendance, and drayage at Liverpool, railway freight to Manchester, and drayage there, approximately, \$6, or 0.83 cent per dozen; commission, insurance, warehousing, handling, and discount at Manchester, \$5.34, or 0.74 cent per dozen; total, \$41.34, or about 5½ cents per dozen. Including all expenses, these eggs cost a little over 17 cents per dozen and sold for 15 cents, a loss of rather more than 2 cents per dozen. This showed that the care taken in selecting and packing these eggs, making them cost 2 or 3 cents per dozen more than the regular market rates in Iowa, was not justified by the market, although it gave a good reputation to the States product. On the other hand, the figures are hardly correct, on a commercial basis, for several reasons. The lots of "fancy" eggs, assorted by colors, constituted too large a proportion of the whole consignment for advantageous sales. A larger shipment would have materially reduced the pro rata expense on a number of items. These eggs were given refrigerator transportation in order that they might accompany butter belonging to the same consignment. This involved needless expense. The transportation of the patent cases added to the cost. These cases, holding only 18 dozen, weighed, with packing, etc., as much as the ordinary cases of 30 dozen and measured rather more, so that by either railway or steamship rates

(weight or measure) 270 dozen eggs in the patent cases cost as much between Iowa and the Manchester market as 450 dozen packed in the usual way. If, therefore, all had been in the regular egg case, the items of transportation charged above at 5 cents per dozen would have been reduced at least to 4 cents.

In regard to the quality of the eggs and the satisfaction they gave to British merchants and consumers, extracts are taken from the reports of the special Department agent and the merchants who supervised the sale in Manchester:

The eggs met with a very good reception indeed, and three or four times the quantity could have been disposed of readily. I believe that they have brought prices equal to and, in some instances, better than the choicest fresh butter. A very select shop took 2 cases, and has them on the counter at the same price as fresh English, namely, 1s. (or 24 cents) per dozen. They are the browns, and present a finer appearance than the English eggs. The proprietor told me this morning that he had taken them home for his own tea table and was pleased with their flavor and freshness.

Respecting the eggs, we can also, we are glad to say, give unqualified praise for the style of packing and for the freshness and condition of the eggs in every respect. The prices returned show how well they stood relatively in the market. The brown eggs take the highest place, and after them the mixed. It would be difficult to place large quantities of the browns, however, and the whites would be in least request. In shipping quantities, the proportion advised would be 2 brown, 6 mixed, and 2 white. The patent cases are not of practical use here. Grocers do not want to keep eggs longer than a week.

The failure to send the 30 additional cases of eggs expected by the steamer *Majestic* was a great disappointment, as all had practically been sold in advance.¹ One dealer, who took 2 boxes of the former shipment, came to the warehouse this afternoon, and was much disappointed at failure to get more. The cooperative stores, which took 3 cases before, had also given an order for eggs from the expected arrival. In the present condition of the market they would have realized more than the shipment by the steamer *Waesland*. I have now visited nearly all the firms which bought our eggs, and the testimony is nearly all one way—eggs well packed and unbroken, fresh, and good flavored.

A baker at Cheetham Hill took 2 cases—1 patent, 1 ordinary. He bought these rather against his judgment and on their favorable appearance, as he was of opinion that foreign eggs were not profitable in the bakery. I called upon him after he had used the eggs, and he reported them good in every respect and satisfactory; and he was disappointed yesterday when he came down to see me that we did not have more for him. He paid 6s. per 10 dozen for our eggs, while the best selected Irish were only 5s. 10d. and reassorted selected 6s. 2d.

Messrs. — & —, who have a select egg trade, took 2 boxes of brown eggs in patent cases at 6s. 6d. per 10 dozen. They retailed them at 1s. per dozen, the same price as fresh English. Evidently this merchant could have afforded to pay more. All the eggs being sound, he sold the 10 dozen for 10s., a profit of 3s. 6d., or over 50 per cent. But most of the retailers, who paid 6s. per "long hundred" on an average, sold at the rate of 16 or 17 eggs for a shilling, or about 7s. 3d. per 10 dozen, thereby making a profit of not quite 21 per cent. * * * Mr. D. took some of these eggs home to test them in his own family, and reported the freshness and flavor to be all right.

¹ A second trial export had been partly arranged, to be made the 1st of May, but these eggs, which had been engaged in Kansas, could not be furnished.

If care is used in selecting absolutely fresh eggs, and only eggs sent which will weigh at least 15 pounds to 10 dozen, and these nicely mixed in color, rather than sorted, they may be confidently expected to realize top figures in the Manchester market. The cleanness of our eggs commends them, and if so packed as to avoid breakage, this is another great element in their favor, as Irish eggs suffer greatly in respect to breakage.

The patent cases seem to have been of no advantage over those in ordinary use. Indeed, more broken eggs were found in the former than in the latter, although it was evident that they had been broken in the process of packing and not in transit. In a few instances consumers thought the eggs in the patent cases, protected by mineral wool, came out rather fresher. One baker, who has always objected to foreign eggs as being so much shaken in transit as afterwards to make it difficult to separate the white from the yolk and prevent the white from beating well, was favorably impressed with the patent case and packing, because it prevented this harmful shaking. But, as Mr. Dowdall wrote, no one wants to keep eggs any length of time in England, and all agreed that the expense of this extra packing was necessarily much greater than any benefit derived from it. The size and weight of the case for so few eggs was severely criticised as being all out of proportion. So far as I have been able to observe and inquire, the eggs in cases with ordinary cardboard partitions have come in equally as good condition as those in the patent cases, and the former are much more favored by the trade. The consensus of opinion was decidedly against the patent case and packing.

Upon the whole, this trial was eminently satisfactory so far as it proved the possibility of sending eggs from the United States to Great Britain capable of competing with the best in English markets as to size, quality, and freshness, but the trade conditions at the time of this experiment and other reasons, as given, allowed no margin for profit in the transaction.

As an addition to this experiment, the Messrs. Dowdall were instructed to reserve three cases of this lot of eggs and hold them in cold storage for some months. This was done, two of the cases being of the patent kind and one of the ordinary form. These three cases were kept until the middle of December, 1898, or seven months. They were then sold to two different parties, who knew the history of the eggs and reported their experience with them. All proved sound and fairly fresh, but those packed in mineral wool turned out looking better and actually fresher on breaking. This method of packing was therefore approved for long storage, provided some modifications be made as matters of convenience, and provided the extra expense is not too great. There was, however, one extra item noted at once, for 90 dozen eggs in the ordinary cases would have been stored at the same rate charged for the 66 dozen. The charge for storage was \$1.20 per case, which was about 5.5 cents per dozen in this case. (For regular cases it would have been but 4 cents.) The whole cost of the eggs apart from storage, and including expenses of sale, was a trifle over 17 cents per dozen. Storage added made the total almost exactly 22.5 cents per dozen. They sold for 23.15 cents per dozen on December 16, 1898. The difference is on the side of profit, although very small. But the original cost of these (unsorted) eggs in Iowa was only 10

cents per dozen, and it is easy to see where at least 4 cents per dozen in the expenses might have been saved, if not 5 cents; this would have left a profit of \$1.50 or more per case of 30 dozen.

Encouraged by the result of this little trial with stored eggs in 1898, it was decided to make a similar experiment the next year on a larger scale and under more satisfactory conditions. Accordingly in the spring of 1899, the Messrs. Boardman were requested to select and pack duplicate lots of 30 cases each of eggs of the regular commercial size and style of packing. In each lot there were 18 cases of the mixed eggs and 6 cases each of the selected whites and browns, thus following the advice of the English merchants as to assortment. Having prepared the two lots, this firm agreed to deliver the first one in New York City late in April by refrigerator line from Iowa at 14½ cents per dozen, and then hold the second lot for eight months and deliver them similarly for 16½ cents per dozen. This was done.

It will be noted that the first lot of eggs cost on arrival in New York 1½ cents more per dozen than the year before; this was due to difference in season, some scarcity of eggs, and a general rise in prices. Also, that the cost of cold storage in Iowa for eight months was only one-half as much as the best rate for seven months at Manchester the year before.

The first shipment of 1899 was made per steamship *Umbria* as regular first-class freight. The eggs left New York the 29th of April and reached Manchester the 10th of May; all were sold before the end of the month. The receivers wrote in advance as follows upon notification when eggs would be sent: "They shall be given best attention, but will arrive at a time when Irish eggs are plentiful and cheap." Late in April the same parties wrote: "You will see by the inclosure [a market circular] that the prices we are quoting for fresh eggs from our Cork house are low. To these (free on board at Cork) must be added the freight to Manchester, about 5d. per hundred, which will make the eggs stand in the latter market at 6s. 4d. per 10 dozen, according to selection. We will place yours in the hands of good customers, and hope for fair prices, although the market is not especially promising." Still later: "The Whitsuntide holidays have considerably upset business, delaying purchases and preventing eggs from being closed out as soon as should have been done. Some have become stale." And May 20: "The eggs are not going as well as we anticipated. Irish eggs being in full season and very plentiful, cheap, and favorably known, have hindered the sale of the States."

As already stated, these eggs cost 14½ cents per dozen, or \$4.35 per case, delivered in New York. The expenses in that city were 7 cents per case for cold storage and 6 cents per case for "cartage, in and out," so that the total cost per case was \$4.48 when placed on the exporting steamer. The ocean freight to Liverpool was 24 cents per case, and the expense of landing and handling, rail transportation to

Manchester, handling and warehousing there, 28 cents additional. The total cost of the eggs at the time of sale in Manchester in May was just \$5 per case, or an average of 16 $\frac{2}{3}$ cents per dozen, white, brown, and mixed. The sales were by the "long hundred," or 10 dozen as the unit, at these average rates: White, 5s. 3d.; brown, 5s. 8d.; and mixed, 5s. 7d. With 3 long hundred to the case the average proceeds per case were, for whites, \$3.83; browns, \$4.13; and mixed, \$3.90. There was a considerable range in the selling prices—from \$3.04 to \$4.38 per case for white eggs, \$3.28 to \$4.75 for brown eggs, and \$3.83 to \$4.38 for eggs of mixed colors. This difference is not accounted for in the reports. The average proceeds were 5s. 6d. per 10 dozen, or \$4.02 per case, or 13.4 cents per dozen. From these proceeds must also be deducted the commission on sales of 3 per cent and the cost of exchange for remitting the net proceeds. Altogether the loss was more than \$1 per case. This was accounted for entirely by the state of the English market, with slow sales and some accidents incidental thereto. There was little fault found with the eggs, as is shown by the following extracts from letters and reports from Manchester:

May 31.—We have cleared all the eggs after considerable effort. Letters from several customers criticise the lack of freshness, and some went bad at the last. In one lot that we sent as far south as Egham, Surrey, but which we had to fetch back again, a good many eggs were broken, and this lowered the average proceeds on the lot. Russian fresh eggs are now arriving here in quantity, and it would not be safe at present to make another consignment of Americans.

The eggs were very good upon arrival—boiled well, and looked fine. The packing of all whites by themselves is not recommended. Customers prefer the browns and mixed. Fresh new-laid eggs like the latter are freely sold in Manchester in dairy shops at good prices, and the States eggs looked equal to any such we have observed in the windows. The packing was very good indeed, but the Americans did not keep so very well. Some complaints of staleness came from a few of the last sold. Those grocers who paid the better prices at the outset had no complaint to make and seemed perfectly well pleased with the eggs. One customer wrote: "The United States eggs are all right, nicely packed, and none broken. Yet they are not up to the fresh Irish in flavor, and we will not order any more."

Considerable care must have been exercised in handling these eggs all along the line of transit, for they arrived here in Manchester with practically no breakage. We had no such good fortune with the only lot sent any distance—four cases got badly smashed. This is not unusual. There is great difficulty in the Irish egg trade, more especially in London. Breakage is so common that the trade is done on delivered terms. In order to cover such losses we are obliged to rail the eggs at the railway company's risk, and for this a high rate of carriage has to be paid.

Although the present is an unfavorable time for your consignment, we see no reason why States eggs should not be as successful here as Canadians a little later. Preserved Canadians are now being quoted freely, and the Russians are being pushed. During last month (April) we handled a quantity of Egyptian eggs consigned to us directly from Cairo, where friends have a packing station. Another firm packs at Ghizeh, and we had some supplies from there. These eggs were delivered here in very fair condition as to breakage. They are, however, very small in size, weighing only 10 $\frac{1}{2}$ to 11 pounds per long hundred (120), and were

sold at 4s. to 4s.6d. per 10 dozen. We think you would do well to try some American eggs here in autumn or early winter.

The early winter shipment already provided for, as described, was made in December, 1899. It was intended to get these eggs to England about the middle of December, but there were some delays and they reached Manchester on the 20th, a little late for distribution through the trade for the best Christmas market. This lot, as stated, was a duplicate of that sent in April. They cost $16\frac{1}{2}$ cents per dozen at New York, or \$4.95 per case. The expenses at New York were practically the same as before. In this instance freight was prepaid through to Manchester via Liverpool per steamship *Germania*, and when the eggs reached the warehouse of Dowdall Brothers, they had cost $\$5.61\frac{1}{2}$ cents per case, or nearly $18\frac{3}{4}$ cents per dozen. The expenses at Manchester, apart from commission on sales, were only $6\frac{1}{2}$ cents per case, so that at the time of being placed on the market there these eggs represented a cost of \$5.68 per case, or almost 19 cents per dozen.

Special instructions had been given in advance to represent these as stored eggs and sell them as quickly as possible after reaching Manchester, to get them into consumption before any deterioration incident to being taken out of long cold storage. Accordingly, 23 cases out of the 30 were sold at once for 8s. per 10 dozen, or \$5.84 per case. But the remainder were held a few days, and, the market improving, they were sold at 9s. and 9s. 3d. per 10 dozen, or \$6.57 and (5 cases) at \$6.75 per case. Therefore, although the actual gain resulting was small, if the selling agents had been given more discretion, the transaction would probably have given a net profit of 15 per cent or more.

Messrs. Dowdall Brothers, of Manchester, reported upon this consignment of stored eggs as follows, under date of January 5, 1900:

Packing excellent. Condition of packages, first rate. No breakages apparent. Eggs themselves looked in good condition, although there was a slight want of gloss or brightness in the shell. We ourselves boiled four eggs, one each from four cases, second layer. Two were all right; two seemed slightly stale. In view of instructions, it was decided to sell quickly without discrimination as to color. All went at same price, wholesale. We can not state, in view of the busy holiday season, how they were retailed. We could have sold a large quantity of these eggs during the last month or six weeks had we had them.

Following are opinions of retail merchants:

Twenty-three cases sold to a Manchester eggler (dealer) at 8s. per 120. He is a most particular man and an inveterate claimer for faults in goods he buys. He made no complaint and seemed to be well satisfied with these eggs. * * * Five cases sold to a large cooperative society at 9s. 3d. ($22\frac{1}{2}$ cents per dozen). The manager expressed satisfaction with the eggs and wanted more this week. * * * Two cases sold to a Manchester confectioner and baker, who was well pleased with them and said they were good eggs.

The same firm, in making settlement, wrote this:

Manchester, January 13, 1900.—As we have not received a single complaint regarding the quality of these eggs, but on the contrary have heard repeated commendations and had other lots asked for, we consider that this consignment has been a success. With respect to the price made, you will be able to judge whether that has also been successful. We are now buying Canadian glycerined eggs at 8s. 2d. and 8s. 4d. per 120 at Liverpool, and in the present scarcity of Russians and with the fresh Irish egg season not yet commenced, these Canadian eggs are having a very good sale.

From the trials above described it appears that the expenses incident to exporting eggs from New York and selling them in Manchester, England, may be estimated as follows per case of 30 dozen and per ton of 40 such cases, sent in ton lots and subject to the changes in rates of freight and local service:

Item of cost.	Per case.	Per ton.
Temporary storing and handling in New York	\$0.16	\$5.00
Freight on steamer, New York to Liverpool .....	.30	12.00
Landing charges (same for 2 tons or more) .....	.025	1.00
Customs charges or "entry" at Liverpool .....	.03	1.20
Attendance, Liverpool .....	.01	.40
Drayage, Liverpool, wharf to railroad .....	.01	.40
Railway freight to Manchester .....	.08	3.00
Drayage at Manchester .....	.015	.50
Warehousing, handling, and fire insurance .....	.06	3.00
Commission on gross sales, 3 per cent.		
Total (besides commission for selling) .....	.71	\$7.50

If market rates are satisfactory, there is room enough for American eggs in England. The imports of the United Kingdom amount to the enormous quantity of 5,000,000 cases, and this trade is steadily increasing, as shown by these statistics:

Quantity and value of eggs imported into Great Britain, 1897-1899.

Year.	Great hundreds (120).	Value (about).
1897	14,031,754	£4,356,087 <i>a</i> \$21,300,000
1898	14,424,601	4,457,117 22,000,000
1899	16,174,760	5,044,392 24,300,000

a Approximately.

Copies of two circulars are appended, giving market quotations for eggs in England in January and June and showing something of the different sources of supply.

On pages following will be found descriptions of several large markets for eggs and the methods in which the trade is conducted.

ring quotations are from the circular of the Continental
ny of June 2, 1899, showing the condition of the egg
hat time:

THE EGG MARKET.

ans. Our own packing:	s. d.
1 Austrians (blues)	5 2
strians	4 10
Austrians (reds)	4 9
nas. Specially recommended, bright, fresh, and colony:	
1 Viennas (blues)	5 3
na's (unassorted)	None.
Viennas (reds)	4 9
Fresh:	
to 18 pounds	7 2
ne Tuesday or Wednesday:	
zlow, about 15 pounds	5 2
about 14½ pounds	5 4
bont 14 pounds	4 11
ties	4 3
medal packing). Specially selected and new laid:	
pounds	6 4
pounds	6 6
pounds	6 9
pounds	7 2
pounds	7 8
pounds	4 2

ights in these circulars refer to the long hundred, or 10 dozen eggs.
oted relate to the same market unit of quantity and are stated in
pence.

wing figures are taken from a price circular of the same
der date January 12, 1900:

ans. Our own packing:	s. d.
1 Austrians (blues)	9 10
strians	8 8
Austrians (reds)	8 6
nas. Specially recommended, bright, fresh, and colony:	
1 Viennas (blues)	10 0
Viennas (reds)	8 6
.....	6 0
These are from our own packing stations at Ghizeh and Cairo.	
y choice, fresh goods:	
.....	Next shipments
ected (good middles)	due Thursday.
ans	s. d.
pounds (boxes, 30 dozen each)	10 0

	Grimsby.
	s. d.
Preserved eggs (continental):	
Austrian reds, 12½ pounds (net)	7 2
Viennas, 13¼ to 14 pounds (net)	7 8
Austrian blues, 14 to 14½ pounds (net)	7 8
Extras, 15½ pounds	8 6
Preserved Canadians. (All in boxes of 3 hogsheds each):	Liverpool.
Glycerined	None.
Limed, 15 pounds	None.

DRESSED POULTRY IN FOREIGN CITIES.

By NEWTON B. ASHBY,

Special Agent of Bureau of Animal Industry.

MANCHESTER.

From the middle of June till Christmas Irish and English supplies of poultry are abundant and there is no room for foreign poultry at a profit. From January 1 to June 1 the chief foreign supplies come from Russia and Australia. The Russian supply begins in December or January and continues to June. The Australian supply is chiefly confined to March and April. The best months for foreign business is from December 15 to April 1. The Russian supply is not satisfactory, for the reason that the Russians make no effort to cater to the trade in the way most profitable. Their fowls are packed in boxes containing from 80 to 130, and all ages, sizes, and sexes are packed together indiscriminately. These are rough plucked, and in some cases the intestines have been drawn through the vent. The Russians ship during the winter months, when fowls are frozen by natural means. The fowls are consigned chiefly to agents at Hull and London, who put the supplies, as soon as received, into cold stores, and from there supply the English markets as demand requires.

In the Manchester market birds under a year old are called "chickens," and retailers pay for Russian chickens weighing 3 pounds from 14s. to 16s. per dozen. Chickens over 1 year old are called "fowls," and retailers pay for Russian fowls about 12s. per dozen.

The Australians send their chickens to agents in London, who put them in cold stores and supply the markets from that point. They send only "chickens" from 8 to 10 months old, and they divide them into two classes: (1) Cockerels weighing from 3½ to 4 pounds plucked; (2) cockerels weighing from 2½ to 3 pounds plucked. They are packed in cases holding 1 dozen, and each chicken is wrapped in butter parchment paper. This supply is regarded as equal to fresh English and Irish, and retailers pay from 24s. to 28s. per dozen for them.

Turkeys.—The chief demand for turkeys is in December, and supplies are sent from Ireland, France, Italy, and Hungary. France gives special attention to the December turkey trade and competes successfully with Ireland. Turkeys bring from 6d. to 8d. per pound.

There is a demand at Christmas time for large birds weighing 20 pounds and upward rough picked, and it might be well to try the market with a small consignment of heavy birds. They should reach this market by December 15, and not later than the 18th.

There are several reputable dealers in poultry in Manchester, located generally in the fish and poultry market. It is not, of course, within the province of this report to extend special recommendation to any particular firm or firms. It may be said, however, that confidence is rarely misplaced when extended to leading dealers bearing a well-established reputation.

I believe that the trade in dressed poultry is a very risky business, and, unless great care is exercised, likely to give very unsatisfactory results. If shipments are made to Manchester, I would recommend that turkeys be sent from November 15 to December 20; that chickens be sent from January 1 to April 1; that with both chickens and turkeys the Australian method of packing be followed, namely, that birds be packed in small cases and that they be of uniform size in each case.

Birds should be allowed only gruel for several hours before killing, in order that the crop and the intestinal tract be clear of solids. It is preferred that killing should be by means of piercing the brain from top of the throat through the mouth, as this leaves no external wound. Birds should be dry plucked; in Manchester they are usually rough plucked. If drawn, the intestines should be drawn through the vent, and vitals—as heart, lungs, gizzard, etc.—should be left undisturbed. Birds must then be thoroughly cooled and chilled, and then packed and hard frozen in the case. If the weather is cold, I should think thorough chilling sufficient without freezing. I have seen chickens from Queensland packed 15 in a case transversely, the width and depth of the case being just sufficient to hold one bird. These birds were not separately wrapped, but were packed very closely and all inclosed in a thin muslin cloth. The two halves of the case are fastened together with hinges, so that the case may be opened and examined at will. Birds in these cases are frozen solid and kept in fine condition. The head of each bird should be wrapped with either paper or cloth to prevent bleeding.

LONDON.

The London trade differs from that of Manchester in that it requires fowls to be clean plucked, except as to feathers on the upper half of the neck and the tuft on the tail. Chickens should not be drawn, or, if drawn, then only through the vent. Piercing the brain through the mouth is the method of slaughter preferred. Turkeys are to be clean plucked, except as to feathers at the top of the neck, tip of the wings, short tail feathers, and a bunch of feathers over the thigh bone joint,

as flesh is thereby protected from bruising at this most vulnerable point. London, as well as Manchester, receives its chief foreign supply from Russia. The service is very unsatisfactory, because of the method of shipment in large boxes, and, besides, the birds are not assorted. In the middle of June they bring from 1s. 3d. to 1s. 6d. each. Queensland chickens in the market at the same time, packed in cases containing 15 and weighing from $2\frac{1}{2}$ to 3 pounds each, were held at 3s. per bird. I saw some turkey poults from Queensland in crates holding two dozen. The crates were narrower at the bottom than at the top, and wide enough to hold two birds packed transversely, the heads turned toward the center and the breasts turned down, fitting into the narrower portion of the crate; hence the crate contained two layers of one dozen each. They were in fine condition. The best markets for foreign fowls are from February to June, as home supplies pretty well meet the demand from July to January. Old fowls are not wanted at all. Cocks and hens should be packed in separate cases, and cases should contain birds of about the same weights and ages. Cases which hold about two dozen are preferred. Plump, well-assorted chickens from 8 to 10 months old and weighing from 3 to 4 pounds, if properly killed and shipped, could be expected to realize from 2s. 6d. to 3s. 6d. each for the foreign poultry season. Of course the price will be affected by season and supply.

The best turkey market is at Christmas time, when heavy young turkey cocks in good condition could be expected to realize from 10d. to 11d. per pound, and good weight turkey hens 8d. per pound. Dealers in general hold out no encouragement for the turkey trade except at the Christmas holidays. However, one dealer was of the opinion that really good turkeys, killed, prepared, and shipped in proper condition, would yield satisfactory results from January to May.

The London poultry trade is conducted on a commission basis, the usual percentage being 5 per cent of the gross sales.

BRISTOL.

In Bristol there are no wholesalers of poultry and no direct shipments of foreign-dressed poultry to that port. James Bigwood, Baldwin street, Bristol, carries on a large retail fish and poultry trade, and bears a good reputation. Bristol is in the heart of a fine agricultural section, and the English and Irish poultry supplies the demand through the summer season. From Christmas until May there is room for imported dressed poultry. For the Christmas trade Mr. Bigwood estimates that large turkeys, put on the market in proper condition, would bring 10d. per pound. This would be \$4 for a turkey cock weighing 20 pounds. The Bristol poultry must be clean plucked, and should be put up in small packages containing not more than two dozen chickens to the crate.

HAMBURG.

The summer trade in Germany is confined chiefly to home-grown chickens and geese. The trade with chickens is in young birds weighing when dressed about 1 or 1½ pounds, called "küekin." The trade in imported dressed fowls is confined to the winter months, when the chief supplies come from Russia and Hungary. The Russian birds are preferred to the Hungarian, and from what I could learn the trade is of much the same character as in England. Birds should be clean plucked and drawn through vent. The Russian fowls bring from 1 to 1.8 marks. The duty on imported dressed poultry is 12 marks per 100 kilos net, 16 per cent being allowed for tare. Herr William Fromme, poultry merchant, was of the opinion that only turkeys weighing from 7 to 9 pounds could be sold to advantage, and these bring from 3 to 6 marks. He charges 12 per cent on gross sales, which covers all expenses of shipper when poultry has been landed duty paid. Herr Theodore von der Brelje, poultry merchant, stated that some turkeys from New York were in the Hamburg market in January, 1898. Their weights were about 12 pounds each and they realized 55 to 60 pfennigs per one-half kilo, or from 13 to 14½ cents per 1.1 pounds. He was of the opinion that heavy turkeys weighing from 16 to 20 pounds could be disposed of at the Christmas season at 11 to 12 marks each. His charges are 10 per cent of gross sales, and this covers all expenses incurred after poultry is delivered at port duty paid. In addition to the Russian and Hungarian supply, the French send to the German markets a class of chickens known as poullard. These bring from 4 to 6 marks each, in accordance with size. Mr. Brelje was of the opinion that if we could send carefully assorted young birds, weighing from 3 to 4 pounds dressed, we might reasonably expect to secure nearly as good prices as are paid for the French poullard. Messrs. Louis Kitz & Co. were of the opinion that it is worth while to make a trial of this poultry market.

My opinion at this time is that our surplus poultry can be disposed of to better advantage in England than in Germany, but further investigation might cause me to modify this opinion.

PREPARING POULTRY FOR THE LONDON MARKET.

By S. LOWE,

London, England.

All poultry, whether fowls, turkeys, ducks, or geese, should be fasted at least twenty-four hours before killing, and should not have access to water. Two modes of slaughtering are practiced in England: (1) By breaking the neck immediately behind the skull; (2) by running some sharp instrument (as a narrow-bladed knife) through

the roof of the mouth into the brain. In the former method the rupture of the blood vessels of the neck causes the blood to accumulate about the fracture, and this mass, when thawed out after refrigeration, becomes wet and unsightly, and, although the latter method takes double the time of the former, it is much to be preferred in the case of the poultry which are to be frozen. After the birds have been killed by this means and allowed to grow cold, their mouths should be stuffed with tow, cotton waste, or some similarly absorbent material.

Fowls should be clean plucked, excepting 1 or 2 inches of the neck. Turkeys should also be clean plucked, except a proportionate quantity of feathers on neck, and feathers may be left on last joint (tips) of wings, excepting that the large flight feathers should be removed. On ducks and geese, leave only neck feathers and all shorter wing feathers.

There are many styles of sending fowls to market, but the most suitable is that practiced by the Cambridge and Lincolnshire farmers, namely: While the bird is still warm the legs should be doubled close to body and the bird placed on the edge of table breast downward, so that the head hangs down. If they are placed in a row thus and a weighted board laid on their backs until they have thoroughly set, they will all be evenly shaped. Ducks and geese should be similarly treated, with the exception that the feet should be twisted back so that they lie upon the back of the bird, the wings being treated in much the same way. Turkeys should have their wings lightly tied to their sides and be hung up by their extended legs to cool. Any attempt at shaping a turkey is useless except in cases of birds with very prominent breastbones, when the bone should be broken down or cut by inserting a long stiff knife either through the vent or under the shoulder. Do not remove the entrails of any poultry.

On no account use boiling water to facilitate plucking. The London trade will not buy poultry treated in this way. In the case of fowls with feathers on legs, remove all the feathers possible.

Chickens of, say, 2 pounds weight and upward sell well here from early March till end of June. The later arrivals should be heavier. Large cockerels, 4 to 6 pounds, would command high prices and should be sent separately from hens. I would suggest none being sent after the spurs become the slightest pointed. Roughly speaking, old fowls realize half the price of young ones. Pullets would be considered old after having commenced to lay.

In order to establish a regular demand for a brand of poultry, great care should be used in packing and grading. Two dozen fowls or ducks would be a good number to be packed in each case. Fowls, as nearly as possible of equal weight, should be packed together and description stenciled on outside, as "24 chickens, 72 pounds, net weight" and "24 cockerels, 100 pounds, net," and so on. Ducklings should average from 4 to 6 pounds to be a good sale here. Geese, 10

pounds upward, but not to exceed 12 or 13 pounds if possible; 10 to a case. Turkeys should be graded carefully, say, in equal-sized cases, 12 to 20 hens, 6 cocks of 18 pounds and over, etc. It would be advisable, I think, to wrap each bird of whatever kind in butter cloth or grease-proof paper—at least ducks and fowls. Guinea fowls may be killed in the same manner as other fowls, but do not dress them. They may be packed 2 or 3 dozen in a case.

Highest prices for ducks and fowls are secured during February, March, April, May, and perhaps June. Turkeys and geese are for the Christmas trade only and should arrive at least fourteen days or three weeks before Christmas day; guinea fowls in February, March, and April. If they are good—say $2\frac{1}{2}$ pounds average—they often bring very high prices.

Respecting age, fowls may be sent of any age up to 6 months if of fair size, but never send pullets that have laid or cocks with pointed spurs, as prices for this description (i. e., old) would average only 1s. 6d. to 1s. 9d. Ducks may be sent during the first twenty weeks after hatching. Aylesbury breeders kill at from 10 to 13 weeks of age and produce 5-pound birds at this age. Old geese (that is, second season geese) are worthless here. Turkeys in the case of very large gobblers, 18 pounds upward, make a good price at Christmas if spurs are not more than three-quarters to 1 inch long, and fat hens of the second season sell very well, but of course not equal to same size and younger.

Never send starved or very thin birds; we have too many here.

Approximate prices: Fowls, $2\frac{1}{2}$ to $3\frac{1}{2}$ pounds, 2s. 6d. to 3s. 6d.; cockerels, $3\frac{1}{2}$ to $5\frac{1}{2}$ pounds, 3s. 6d. to 4s.; white ducklings, 4 to 6 pounds, "English," 3s. 6d. upward to, say, 6s. 6d.; geese, Canadian, refrigerated, last Christmas (1897), 6d. per pound. Turkeys, hens, 6 to 8 pounds, $6\frac{1}{4}$ d. to $7\frac{1}{2}$ d.; cocks, 12 to 14 pounds, $7\frac{1}{4}$ d. to 8d.; cocks, 14 to 16 pounds, 8d. to 9d.; cocks, 16 to 18 pounds, 10d. to 11d.; cocks, 18 pounds and upward, 1s. Guinea fowls, very irregular, 1s. 9d. to 3s. 6d.

BRISTOL EGG TRADE.

The Bristol egg merchants, like the butter merchants, find their best market in South Wales. The demand for imported or foreign eggs is considerable throughout the year, but it is stated that the home supply is increasing from year to year. The Bristol egg imports are chiefly from France, Ireland, Germany, and Austria. Canadian eggs are making a bid for the markets of this district. A prominent firm were quoting eggs on June 29 as follows, per 10 dozen:

	s.	d.
Finest selected French.....	7	6
Finest selected Irish.....	6	8
Finest selected Austrian.....	5	4
Finest extra Austrian.....	6	2

Eggs of nicely mixed browns and whites are the more profitable for this market. There is a limited demand for all brown, but the extra price of 2d. to 4d. on 10 dozen would hardly pay for selecting. The size of cases is immaterial. The Canadians come in the ordinary American egg case.

EGG MARKET OF PARIS.

By NEWTON B. ASHBY,

Special agent, Bureau of Animal Industry.

Eggs sold in Paris are subject to a municipal tax called "octroi" of 2.40 francs per 100 kilograms; if sold in the central market, to a further charge of 1 franc per 100 kilograms, and 15 centimes per package for handling. Imported eggs are subject to the revenue tax or duty of 6 to 10 francs per 100 kilograms. All the above charges are on net weights. The unit of sales established in the central market of Paris is 1,000 eggs, or mille. It is the French custom to consign eggs to market in packages containing 1,000 eggs. The usual package is the willow basket. The basket for eggs is about 4 feet high and probably 30 inches in diameter at top and 6 inches less at bottom. The packing material is commonly straw. Foreign eggs usually come in packages containing 1,440 eggs. These packages are of light wood and the packing material is either straw or wood shavings. The commissions charged by the mandataires, or facteurs, are 3 per cent on gross sales.

The English unit of sales is the 10 dozen, and the average weight of eggs should be about 15 pounds to the unit. The same weight for 10 dozen applied to the French unit of 1,000 should give the average weight of the unit of sales as 56 kilograms. French eggs weigh from 54 to 66 kilograms per 1,000. These large eggs come from Picardy and are about the size of ordinary turkey eggs. When I visited the markets, the Picardy eggs weighing 60 to 66 kilograms per mille were worth 106 francs per mille, while eggs from south of France weighing 54 kilograms per mille were worth 68 francs per 1,000. The first-mentioned eggs were worth about 24 cents per dozen, while the latter were worth only about 16 cents. This is a fine object lesson in values as between high-class produce and the ordinary. These larger eggs, in addition to greater weight, are considered to be of finer flavor and quality. The comparison of weights are about as 6 to 5, while the values are about as 3 to 2. While the import of foreign eggs does not usually begin until later in the year, yet this year several cases of Russian eggs were already upon the market. They were packed in wooden cases of light slats, and the eggs packed in wood shavings. Their weights were about 54 kilograms to 1,000, and they were valued at about 62 to 64 francs per 1,000. The value of similar eggs in Sep-

tember would be 70 to 75 francs. I was told that later in the season some Egyptian eggs packed in cardboard fillers would come upon the market.

QUANTITY.

I was unable to secure statistics of the Paris egg trade for 1897, but M. Ch. Seelles kindly furnished me with a "Review of the egg trade of 1896," prepared by himself and published in *La Revue Agricole*, March 15, 1898. From this article I take the following:

Consignment of foreign eggs to Paris in 1896 in kilos amounted to 930,000, as against 541,300 kilos in 1895.

The weight of eggs brought into Paris in 1896 in kilos amounted to 25,669,102; in 1895, 24,589,962. There were sold in the Central Market, Paris, in 1896, in kilos, 16,568,014, as against 15,988,650 in 1895.

The price of eggs in 1896 per 1,000 was 85.05 francs, as against 87.31 francs in 1895; and in kilos in 1896, 1.41 francs, as against 1.43 francs in 1895. A kilo represents about 15 large eggs, 17 average ones, and 22 little ones.

Nothing is said in this review about the number coming into market, but if the average of the numbers of the three classes is taken, it will be found that there are 18 eggs in the kilogram, and 55½ kilograms in the 1,000; or, if 17 eggs are taken as a kilogram, then 1,000 would contain nearly 59 kilograms. I take it that 57 or 58 kilograms would be about the average weight of French eggs, and if we take 58 kilograms as representing 1,000 eggs, then the eggs sent to Paris in 1896 numbered about 443,000,000. Sixty per cent of the home, or French, produced eggs were sold in the Central Market, and all of the imported ones. The countries importing were Austria, Hungary, Germany, Russia, and Egypt. Of the 930,000 kilograms imported in 1896, about 50 per cent were from Austria-Hungary; about 32 per cent from Germany; about 15 per cent from Russia.

If the average of prices in 1895 and 1896 are taken, a kilogram of eggs were worth, wholesale, 1.42 francs, or 27½ cents; and taking 17 eggs as the average per kilogram, 10 dozen eggs averaged \$1.93, or nearly 8s. The present price of Russian eggs, however, is only 7.50 francs, or \$1.45, or 6s. In May, Russian eggs were worth in Manchester about 4s. 9d. to 5s. per 10 dozen.

SYSTEM OF SALES IN CENTRAL MARKET.

The sale of eggs is affected both by the market ordinances and by the agreement existing between the *facteurs*, or *mandataires*, on the one hand, and the delegates of the *Chambre Syndicate* on the other. The *Chambre Syndicate* is an organization comprising the chief retailers of Paris. The agreement between the agents and the retailers bears date of February 24, 1885. By this agreement the custom of giving 1,040 eggs for 1,000 was abolished, and in its stead it was agreed that the eggs should be verified, both as to numbers and condition, by inspectors appointed by the prefect of police, and that

the seller should make good all losses. The eggs must be examined out of the presence or influence of either buyer or seller or their agents or employees. The inspectors, called *compteurs-mireurs*, are required to make certified lists, as follows: (1) of all eggs missing, broken, or spoiled; (2) of two-thirds of the number of dirty eggs; (3) of one-half of the number of little eggs (a little egg is one that will pass through a ring of the diameter of 38 millimeters, or nearly 1½ inches); (4) and of one-third of the chalky or stale eggs. (That is, three dirty eggs must be given to count as two sound ones, two little ones as one, and three stale ones as one.) The agreement further provides that the unit of loss shall be 5, and if the loss in any package is not over 2, then there shall be no loss; but if 3, then the seller must allow for 5; if the loss is 7, then the loss is counted as 5, but if 8, then the loss is counted 10, and so on. The package may be returned to the seller when half the eggs are dirty or rotten or one-tenth of them stale. When a package has been returned, the agent may resell, and if he resells to a purchaser who has been put in possession of all the facts relating to the return by the first purchaser, the second purchaser can not return the package. The cost of counting is fixed by ordinance at 25 centimes for 1,000 eggs, the cost of examining "mirage" at 60 centimes, and of passing through the ring at 15 centimes; but if the number of small eggs in the 1,000 is less than 10, the inspector receives no pay for this work. The cost of counting is borne by the purchaser when the loss is under 10, but if over 10 the seller pays the cost; likewise the cost of examining for spoiled and stale eggs "mirage" is borne by purchaser when these fall below 15 in 1,000, but when over that, by the seller. The package containing the eggs must be returned to the agent within five days, or the buyer must pay a fine of 5 francs for each package not so returned.

The ordinances of the markets fix the hours of sale by auction, and also by private treaty require the unit of sale to be 1,000, and a market to be held every morning except Sunday, beginning at 7 o'clock in summer and 8 o'clock in winter. The ordinances establish also the bureau of inspectors, *compteurs-mireurs*, for carrying out the verification as agreed upon between *facteurs* and *Chambre Syndicate*. This bureau consists of 95 men, of whom 77 are counters and examiners and 10 assistants. The 8 remaining are the officials of the bureau. They are all under the prefecture of police, who makes the rules for their government. The counters must go anywhere in Paris for verifying any package or packages of eggs sold in the central market, but they must not verify any package of eggs bought elsewhere. The package of eggs to be verified must be in the same condition as when it left the market. The counter must refuse to verify any package that had been opened or otherwise tampered with, and it is his duty to report such cases to his superior without delay. The verifying is required to be done by the inspectors apart from any persons whatever not members of the bureau of *compteurs-mireurs*.

This force is required to be present on the market during sale hours, and, when required, to verify the number of small cheese in a package, or the number of half-kilos of butter in a package when consigned in lumps of one-half kilo weight, but this work must be done in market place during hours of market. The verification of eggs is made at the places of business of purchasers.

At M. Paitin's I found that for purposes of retail he has the eggs put up in cardboard case with cardboard filler containing 6 eggs and a wooden case containing 12 eggs in cardboard fillers. These were French eggs weighing about 16 pounds to 10 dozen. The half dozen were sold for 85 centimes, and the dozen for 1.10 francs, and a charge of 15 centimes additional for this box unless the same was returned. The package containing a half dozen was supposed to be of better quality.

EGG SALES OF PARIS, 1896.

[An article in *La Revue Agricole*, May 15, 1896, by M. Ch. Scelle, translated from the original by Newton B. Ashby.]

In accord with your request made at the meeting of the Industries Aricales, March 20, I now give you a review of the egg commerce for 1896. My reply, as in former years, is based upon official documents drawn up in the remarkable annual report of M. Genest, concerning the municipal services in the provisioning of Paris:

	Kilograms.
The quantities brought in in 1896	16,568,014
The quantities brought in in 1895	15,988,640
The increase for 1896 was	579,374

The temperature was favorable, and also the increase of poultry, which had greatly increased on account of cheap grain. The consignments would have been even more increased if it had not been for opposition from sales made in the commission houses. The increase came chiefly from the foreign imports.

The consignments in the order of importance were as follows:

	Kilograms.
Orleanais, Breuce, Vienne, Creuse, Vendee, and Mide	6,282,000
Normandie, Bretagne	5,709,200
Picardie	1,265,100
Burgogne, Bourbonnais, Ninesnaes	1,254,560
Brie et Champagne	651,600
The foreign imports reached in 1896	930,400
Against the foreign imports in 1895	541,200
Being an increase of	389,200

These importations were divided as follows:

Austria-Hungary	470,000
Germany	291,500
Russia	139,700
Egypt	29,200
Total	930,400

It will be seen that in 1896 the importation of foreign eggs was greater than in 1895, and a reference to an article which was published in No. 2 of *La Revue Agricole*, January 10, 1897, will show that the importation (1896) was 413,058 kilos less than in 1894, and represented 2,311,150 eggs. The foreign eggs are generally smaller than those of the home provinces. They are inclosed in great cases of whitewood, each containing 1,440 eggs; hence they are recognized by the original package. These eggs, with rare exception, are sent forward by express trains and arrive upon the market after a journey varying from three to eight days.

On account of the journey and the handling at the railway station, it is rare that a package does not contain more or less stained eggs. It is the business of the inspectors to determine the losses; that is to say, the eggs to be deducted or allowed for to the purchaser in making settlement.

The cost of counting is fixed at 25 centimes for 1,000 eggs, that of examining at 60 centimes, and that of passing through the ring at 15 centimes. All are considered little eggs which pass through a ring of 38 millimeters in diameter. The eggs of the South are the smallest; those of Calrados and Eure the heaviest and largest.

Following is the number of eggs coming from France and imported, consigned to the Central Market:

	Total.	France.	Imported.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
In 1896	16,568,014	15,637,814	930,200
In 1895	15,983,640	15,447,440	541,200
Increase in 1896	579,374	190,374	389,000

From portions of the French article, here omitted, it appears that a large quantity of eggs are consumed which are not sold through the Central Market.

The average price of the 1,000 eggs in 1896 was 85.05 francs; in 1895 it was 87.31 francs. The average price of the kilo was 1.41 francs in 1896 as against 1.43 in 1895. A kilogram represents about 13 large eggs, 17 average-sized ones, and 22 little ones.

	<i>Kilograms.</i>
The quantity reshipped in 1896 was estimated at	1,135,900
The quantity reshipped in 1895 was estimated at	1,120,000
The increase being	15,900

There were withdrawn from the settlement of the accounts (that is, charged back) in 1896, 561,633 eggs; in 1895, 612,776 eggs, showing a decrease of 15,143 eggs.

There is collected for the right of introduction into the Central Market a charge of 1 franc per 1,000 kilos. There were collected—

	Francs.
In 1895	161,327.20
In 1896	167,001.60
An increase in 1896 of	5,674.40

POULTRY MARKETS OF PARIS.

By NEWTON B. ASHBY,

Special Agent, Bureau of Animal Industry.

The supplying of Paris with poultry is chiefly by the facteurs of the Halles Centrales, or Central Market, in Pavillion No. 4, which is detailed to receive poultry and game for sale. During 1896 game and poultry consigned to Paris represented a weight of 31,058,120 kilograms, or 68,470,731 pounds avoirdupois. Of this 25,058,120 kilograms, or nearly five-sixths of the whole, were consigned to the Halles Centrales. In poultry proper the consignments to the Halles Centrales represented:

	Kilograms.
7,393,806 chickens, weighing	11,090,709
863,755 ducks, weighing	1,295,633
650,621 geese, weighing	2,277,173
398,911 turkeys, weighing	1,595,644

Nearly two-thirds of the total consignments, namely. 16,259,159

SOURCE OF SUPPLY.

The Paris markets are supplied chiefly from the French districts. The French departments contributing the largest supplies are as follows: Loiret, Eure-et-Loire, Loire Inferieur, etc. From Houdon, in Eure-et-Loire, come chickens bringing the highest prices because of weight and quality. The Houdon fowl (pronounced Oodah) as a pure breed is said to be chiefly in hands of amateur breeders, but a cross of this breed upon the Cochin produces a fowl called Faverolles, which is highly esteemed on the markets. These fowls attain weight of 2 kilograms at four to eight months, and the quality is extra. Foreign imports of poultry and game amounted in—

	Kilograms.
1894 to	1,931,825
1895 to	1,848,500
1896 to	1,925,890

These weights represent large game, rabbits, hares, pheasants, and grouse, quails, reed birds, plovers, etc., and all classes of poultry, but in what proportions I can not say, further than that the poultry

imports proper increased 30,750 kilograms in 1895 over 1894, and in 1896 again increased over 1895 by 73,150 kilograms, thus indicating that Paris offers a steadily improving market for imported poultry.

METHODS OF PREPARING AND SENDING TO MARKET.

The French are economic people, and the system of sending young and immature chickens to market is not practiced. The fowls sent to market are from 4 to 8 months old. They are carefully fed and grown for market instead of being allowed to scavenge. For instance, the chickens are given clean water instead of being allowed the run of filthy pools and puddles. The method of slaughter seems to be chiefly by cutting the jugular under the ear. The fowl is then dry-plucked very carefully to prevent tearing of the flesh, and is drawn through the vent. The legs are then drawn backwards and caught under the wings. This spreads out the fowl so that it cools better, and also gives a square, plump appearance. The fowl is now set up with its back against the wall to cool. The fowls are all clean plucked except the feathers about the top of the neck, tip of wing, and perhaps a few feathers on foot or lower leg. Each district has its own peculiar methods of leaving feathers to indicate the district of origin. When thoroughly cool the fowls are packed in baskets or boxes. Willow baskets seem to be very commonly employed in France for all sorts of produce. First a wisp of straw is bound about the throat to prevent issue of blood, then a layer of fowls is put in the package, then a layer of straw, etc., until the package is full. Fowls are not wrapped separately. Rye straw is preferred, and it must be dry and clean. The packages vary in size, shape, etc. The fowls are packed the afternoon or evening of the day of slaughter, and dispatched to Paris by special express train that night. They are due in Paris before 5 o'clock in the morning. They are delivered at once to the market, and are sold on the market the day of arrival, so that French fowls are generally disposed of in the general market within 20 to 24 hours after being killed. Poultry imported from foreign countries come in large boxes, packed in layers, with a strip of linen or calico cloth separating the layers. These come chiefly from Austria, Bulgaria, and Italy, and the trade is chiefly during the winter months, as the Paris markets, and French markets generally, do not take kindly to foreign poultry or meat. Russia has endeavored to introduce foreign poultry without success. The imported chickens weigh about one-half kilogram each, and usually bring from 1 to 1.10 francs each. In July and August many French fowls come to the market alive. But this practice is resorted to only in hot weather, because of the greater cost of transport, etc., and because the octroi on live fowls per 100 kilograms is the same as on 100 kilograms dressed.

METHODS OF SALE.

The sales of both living and dressed poultry are made in the Halles Centrales generally by auction *à la crier*. The markets must be held daily at the hours fixed by the ordinances, and the charges are all fixed by ordinances except the commission of the *facteur*, which is left to agreement. The usual commission, I learned, was 5 per cent on gross receipts. The costs of marketing in Paris, outside of transportations, commission, and similar charges of much the same nature universally, are first the octroi levied by the city of Paris on all merchandise entering the city. Poultry and game are divided into four classes for the purposes of octroi. Chickens, live and dressed, and domesticated poultry generally, with the exception of geese, come under the second class, upon which the octroi is 30 francs per 100 kilograms, or at the rate of about $2\frac{1}{2}$ cents per pound. If sold in the Halles Centrales, 2 francs per 100 kilograms are charged as rights of market. French-grown poultry is subject to these charges equally with imported, but imported poultry pays a customs duty of 20 francs per 100 kilograms. Hence rights of octroi, markets, and customs amount to 52 francs per 100 kilograms net (live or dead weight), or at rate of about $4\frac{1}{2}$ cents per pound. The Paris market prefers a white and smooth skin in both chickens and ducks, and a yellow-skin bird will not bring so much money. The poultry are sold by the head, but size in connection with the quality determine the price.

PRICES.

Chickens reach about the highest prices in May, and the lowest in August and September. On the 20th of July, when I was on the market, I saw live chickens in groups of six, consisting of cock and five hens, sell for from 12 to 14.50 francs. On the same day dressed chickens realized an average of about 2.30 to 2.40 francs per kilogram; ducks, about 2.40 francs. The average price realized for dressed chickens in 1896 was about 2.25 to 2.30 francs per kilogram, and in 1895, 2.30 to 2.40 francs per kilogram. By referring to the weights and numbers of chickens received in 1896, it will be seen that the average weight was $1\frac{1}{2}$ kilograms, and the average price was consequently about 70 cents. Extra fine capons will bring at times as high as 20 francs each, and 12 francs up for capons at retail is common.

RETAIL PRICES.

At stores of M. Patin I saw the system of retail. M. Patin buys both in the Halles Centrales and direct from producers. The chickens which are shipped to him direct are especially prepared by being wrapped separately in paper. In other respects the system is about the same as for consignments to the Halles Centrales. When they

reach the stores they are classified by sizes and qualities and ticketed with the price. The sale is per head, but quality and size determine the price. The prices ranged from 3.50 to 7.25 francs per bird. One chicken ticketed at 3.75 francs weighed slightly over 1 kilogram, and one at 7.25 francs weighed 2 kilograms. His sale of chickens annually amounts to about 260,000 head.

SUGGESTIONS FOR SENDING POULTRY TO PARIS MARKET.

Birds, whether chickens or turkeys, should be fed with especial care on clean food and given pure water to drink for several days before slaughter. A day or two before slaughtering, the fowl should be fed on gruel in order to clear the crop, gizzard, and the intestines of solids. Chickens should be well grown, plump birds, from 4 to 8 months old, and turkeys as large as possible to be young and tender. Turkeys dressing 10 to 14 pounds, I would think a good size, if fat and plump, for Paris markets. The manner of killing should be that which will most effectually bleed the fowls and leave the smallest wound. All fowls must be dry-plucked and so carefully done that the skin remains smooth and untorn. Feathers may be left at top of neck to conceal the wound made in killing, and also the short feathers on tips of wings and on feet. The entrails must be drawn through vent and then thoroughly cooled. The French method with chickens is to turn the legs back under the wing and set them up with back to a wall in a draft. This treatment adds to the appearance of a fowl as well as assisting the cooling. When thoroughly cool, I would suggest that they be packed in boxes containing about 220 pounds, or 100 kilograms. I would suggest that the fowls be packed very carefully to avoid bruising, and classified so as to have birds of about the same weight and quality in the same package. For the distance to be traversed, it would probably be well to wrap each fowl in parchment paper, and the layers should be separated one from the other by cloth. Fowls should be kept in chill temperature, but not frozen, as frozen poultry is not in demand in Paris. If it be impossible to ship so great a distance without freezing, then I would suggest cases holding from 24 to 30 chickens only, and would pack them in two layers, each layer enclosed in a white muslin cloth.

The months for securing best prices are from October to May. The poultry should be sent directed to the agent chosen at the Halles Centrales, Paris. The agent will pay the custom duties, the octroi, etc. A letter, of course, should be sent to the facteur, advising him of the consignment and of the wishes of the shipper. The package must also show accurately the net and gross weights and tare, the number of birds, and the kinds of each. These are for purposes of customs and octroi and must be accurate.

EGG TRADE IN HAMBURG.

By NEWTON B. ASHBY.

Special Agent, Bureau of Animal Industry.

The duty on eggs is specific, being 2 marks on 100 kilos gross, or on 220.46 pounds. The commission for selling is 2 marks per case of 1,440 eggs and one-half mark to cover charges of landing, drayage, etc. The retail trade is allowed a discount of 5 dozen eggs in every 120 dozen, an equivalent of $4\frac{1}{3}$ per cent. In addition, losses by breakage or bad eggs must be allowed.

The unit of sale is the sechzig trück (60 pieces), or 5 dozen. The standard of weight seems to be about 2 pounds 12 ounces to the 2 dozen, or about 14 to 14½ pounds per 10 dozen. Russian eggs of this weight are now worth 2½ marks per 5 dozen. The next grade of eggs is worth 5 to 10 pfennigs less, and so on. Galician eggs and Hungarian eggs of equal weight are worth 10 to 15 per cent more than Russian, as they reach Hamburg a little fresher. I weighed some Galician eggs valued at 4.9 marks per dozen and found the average to be about 12 pounds 8 ounces per 10 dozen. I saw 7 Galician eggs retail for 30 pfennigs. If quite fresh, they would have brought 50 pfennigs (or about 12 cents). I am told that the retail price of eggs rarely exceeds 1 mark for 7.

The Hamburg market requires white eggs. Browns are not in demand. It is possible that our eggs, if really fresh, would bring more money, on account of greater weight, than any foreign eggs now sold in the market, but I am of the opinion that the English market will give better net results than could be expected in Hamburg or other German markets.

DISPOSITION OF DEAD ANIMALS IN FOREIGN CITIES.

Inquiries at the Bureau of Animal Industry manifest a considerable interest in the disposition of the bodies of dead animals, especially in foreign cities. The information given under this head was kindly furnished through the Department of State. It shows that many points are taken into consideration in the disposal of the bodies of animals, such, for instance, as the use of the flesh for cat and dog meat, the fat for soap making, the hoofs for glue making, the bones for fertilizer, the hides for leather, etc., or, in case the animal died of a contagious disease, its complete incineration. The sanitary phase of the question is of more importance, of course, than the economical. Neither of these conditions is neglected in the cities of the United States, and our people will probably be interested most in those parts of the accompanying reports which treat of the methods employed to dispose of the carcass.

LONDON.

[Hon. William M. Osborne, Consul-General at London, furnishes the following report.]

Horses that die in the streets of London are removed, and those that are incapacitated for work are removed and slaughtered by persons specially licensed according to act of Parliament. One firm in particular has several depots conveniently located in the different districts in and about London. At these depots carts are kept clean and always in readiness to attend at a moment's notice to any call for a dead or injured horse.

All live horses taken to the slaughterer must be killed within three days, but all animals must be kept the full three days and their appearance in no way interfered with—this in case a horse so received should be stolen. The live horses are pole-axed. The hides are sold to be made into leather, mostly for cavalry trousers, carriage tops, boots, whiplashes, etc. The meat is removed from the bones, placed in large kettles, and cooked for cat meat, and the tripe is used for dog food. A fair-sized horse will average 390 pounds of meat. The bones are placed into a digester to remove the oil. The yield is about 25 pounds to 100 of bones. This oil is used by the candle makers for lubricating purposes and also for leather dressing. After the oil is extracted the bones are ground and manufactured into fertilizer. The hoofs go to the glue makers and the bones of the feet to the button makers. The old shoes go to the blacksmith to be remade and used again. The hair from the mane and tail is made into covering for sofas and chairs, fishing lines, etc.

It is estimated that there are annually 30,000 dead and useless horses disposed of in this way in London, 28,000 of which are handled by one firm. This firm has every appliance and convenience necessary for properly conducting this bureau, even to smoke and fume destroyers, which prevent any smoke or odor escaping to the outside. They have also refrigerating chambers that will accommodate 300 carcasses. The establishment is open and at work night and day. The price of a

dead horse or of one that is useless and sent to the slaughter is from \$5 to \$7.50, according to size and condition. The amount is decided and paid by the slaughterer.

By act of Parliament, veterinarians are appointed by the board of agriculture and operate in connection with the police. When a horse is injured in the streets the veterinarian is sent for, who attends with anesthetics, etc. If, in the opinion of the veterinarian, the animal is mortally injured, or for other reasons should be slaughtered, a licensed slaughterer should be sent for, or the veterinarian himself may undertake such work. An ordinary butcher is called in if necessary. The police immediately call for a dealer in dead horses, whose cart is soon on the ground to take the carcass to one of the reducing depots.

The fee for slaughtering an animal is 5s. (\$1.20), to be paid by the owner. In case he refuses, such fee is paid out of the police fund.

In the event that the owner of a mortally injured horse refuses to kill the same or to remove the carcass at once, the police take charge of the slaughtering and removing, in which case it is optional with the owner whether or not he pays the slaughtering fee. Where the owner takes charge of the slaughtering, removing, etc., the police do not interfere.

All dogs and cats that are found astray or dead in the streets are taken to the home for lost dogs at Battersea, London. In order to explain the disposition of the dogs and cats found in the streets of the metropolis, I can not do better than to quote from the report of the chairman of the above institution, Sir George Samuel Measom, J. P.: "Last year, in consequence of the muzzling order, as you have heard, we received into the Battersea home 23,840 dogs. Of these, 19,624 were sent in by the London city council, 2,888 were taken there by the police, 77 by private persons, and 1,351 were brought to be destroyed. Out of the 23,840 received at the home 19,650 were painlessly put to death in our lethal chamber, 2,150 were sold, while 2,044 were restored to their owners; and I have no hesitation in saying that double or treble this number would be restored were owners to show a little more energy in their efforts to recover their lost companions. Last year we also took into the home 240 boarder cats and 280 strays. No less than 29 tons of biscuits, 69 tons of meat, 392 gallons of milk, and a quantity of fish, especially for the cats, formed the total of the provisions consumed during the twelve months."

All dogs and cats that are found dead in the streets or that are killed at the home are cremated.

DUBLIN.

[From Hon. Joshua Wilbour, Consul at Dublin, Ireland.]

In Dublin carcasses found lying in the streets or roadways are regarded as nuisances, and are removed to the cleansing department and buried or otherwise disposed of. If the carcasses are diseased, they are put in a destructor and subjected to a high temperature of steam and boiled down. This work is done by a knacker who has a contract with the city government for the removal and destruction of dead animals found in the streets. When a dead animal is found in private property, the owner must remove it. If the bodies are healthy and fit for food, they are sold by the knacker as cat meat in London and elsewhere. If unfit for food, they are, after being boiled down, made into fertilizer by the addition of acids. In the country diseased animal bodies must be buried by the local authorities under not less than 6 feet of earth, with a layer of at least 1 foot of lime both above and beneath the carcass.

The following is an extract from "The anthrax order of 1899," issued by the lord lieutenant and privy council in Ireland:

DISPOSAL OF ANTHRAX CARCASSES.

"The carcass of a diseased or suspected animal shall be disposed of by the local authority as follows: (a) Either the local authority shall cause the carcass to be buried as soon as possible in its skin in some convenient or suitable place to which animals shall not have access, and which is removed from any dwelling house, and at such a distance from any well or water course as will preclude any risk of the contamination of the water therein, the carcass being buried at a depth of not less than 6 feet below the surface of the earth, and with a layer of lime not less than 1 foot deep both beneath and above it. (b) Or the local authority may, if authorized by license of the lord lieutenant, cause the carcass to be destroyed by exposure to a high temperature or by chemical agents, and for that purpose to be taken in charge of an officer of the local authority, to a horse slaughterer's or knacker's yard or other place approved for the purpose by the lord lieutenant.

"A carcass of a diseased or suspected animal shall not be buried or destroyed otherwise than by the local authority, or be removed from the farm or premises upon which the animal died or was slaughtered except for the purpose of being buried or destroyed by the local authority.

"Before a carcass is removed for burial or destruction under this article, all the natural openings thereof shall be effectually plugged with tow or some suitable material saturated in a strong solution of carbolic acid or other suitable disinfectant. In no case shall the skin of the carcass be cut, nor shall anything be done to cause the effusion of blood except by or under the supervision of a veterinary inspector, and so far as may be necessary for the purpose of microscopical examination.

"A local authority may cause or allow a carcass to be taken into the district of another local authority to be buried or destroyed with the previous consent of that local authority, but not otherwise."

PARIS.

[From Hon. John K. Gowdy, Consul-General at Paris, France.]

The carcasses of animals found floating in the rivers Seine and Marne, the canals of St. Maurice and St. Maur, including the waters of the department of the Seine, are disposed of by a contractor, who is subsidized by the administration. As to carcasses of animals dead or dying in the public streets, their owners have the right to employ anyone they choose to carry them away and to make such arrangements as may be possible as to the conditions and expense pertaining thereto.

In urgent cases and where the dead animal has been abandoned the police officers, who are supplied with a list of horse slaughterers, notify one of the slaughtering firms by telephone or otherwise to remove the carcasses. None of the Parisian horse slaughterers has an exclusive right to the business. Important firms and large companies make a contract for one or more years with a horse slaughterer of their choice. The carcasses are disposed of in the horse slaughterhouse inclosures, which are daily inspected by veterinarians attached to the prefecture of police.

The proprietor of the slaughterhouse reserves the lungs and the hides of each horse killed or brought in dead, to be placed for inspection before the veterinarian for his decision as to the existence or nonexistence of any contagious or other diseases. The owner of the carcass must deliver at the slaughterhouse the entire carcass, no portion lacking, to avoid the possibility of diseased meat being employed in any way.

Special records are kept of these slaughterhouses, in which appear the deliveries of carcasses, with the names of the owners of same. This particular service is

under the supervision of the prefect of police. When an immediate removal of a carcass is made by order of the police, the value of the product of the carcass goes to the owner of the same, he, however, having to defray the expenses pertaining to the operation.

There are at present in Paris three firms in the horse-slaughter business. Men employed in this occupation earn from 5 francs (96 cents) to 6 francs (\$1.15) per day, exclusive of *pourboires* (tips). Dead horses are removed in wagons or carts called *corbeillards*. Disabled or wounded horses are removed in low-hanging covered carts called *monte à regret* (enter with regret). The two models of carts are provided with levers and pulleys for handling the carcasses and are thoroughly washed and disinfected every day.

BERLIN.

[From Hon. Frank W. Mason, Consul-General at Berlin, Germany.]

The carcasses of horses, condemned cattle, and other animals from the abattoirs, and of dogs killed at the city pound, are disposed of under a system based on a contract which will be hereinafter described, and by a process or apparatus invented and patented by Mr. Rudolph A. Hartmann, of Berlin. The same system and similar apparatus are employed at Königsberg, Breslau, Emden, Mayence, Bonn, Schweidnitz, and Stett, as well as at Caracas, Venezuela, and may be said to represent the latest and most advanced application of German science in that direction.

The plant used for this purpose in Berlin has been recently set up on land belonging to the police department in a remote northeastern quarter of the city. These premises have been leased for ten years to the highest bidder, namely, the contractor who has undertaken by agreement for that period (1) to gather up and dispose of all domestic animals which are killed by accident or die within city limits; (2) to accept and dispose of all condemned animals and parts of carcasses of condemned meats from the municipal abattoirs; (3) to keep in service a prescribed number of wagons for the removal of wounded animals from the street, which must be done within a fixed time after notification in each case by the police. For the dead or fatally wounded horses the contractor pays to the owner of the animal from 10 to 30 marks (\$2.38 to \$7.28), according to agreement, and acquires thereby full title to the carcass. For the condemned animals and meats from the abattoirs he must pay prices agreed upon between himself and the *vieh versicherungs-gesellschaft* (cattle insurance company), an organization which for a certain premium insures the animals of farmers and drovers against the chance of condemnation by the veterinary officers at the abattoirs, who inspect rigidly every animal before it is admitted to slaughter. The animal so insured and condemned becomes the property of the insurance company, which sells it to the contractor, as above stated, and at a price mutually agreed upon, and which depends naturally upon the species and size of the animal, its condition as to fat, and the disease by reason of which it was condemned. An animal dying of anthrax, for instance, is worth nothing, but comes gratis to the contractor and must be destroyed. None of its fat, hide, or tissue of any kind can be used, except its ashes for manure. With this exception, which is ordained as a natural measure against the spread of contagious diseases, all dead and condemned animals which come into possession of the contractor are worked up by the apparatus of Mr. Hartmann, and yield, besides skins, three products, namely, fat, used for soap making, axle grease, etc., glue, and animal fertilizers; and out of these the contractor derives the revenue which recoups his outlay, and yields, theoretically at least, a moderate profit.

Besides condemned animals and meats from the abattoirs and the stray dogs which are caught and killed by the police, the plant at Berlin disposes of about

fifteen horses per day. These, as well as the other animals, are first skinned. The carcasses are then cut up by hand and placed with the viscera in one of the perforated trays, of which three are arranged to slide into each of the large iron cylinders which form the principal feature of the apparatus. The trays being filled and in position, the cylinder head is closed and firmly secured, and steam heated to a pressure of four atmospheres (58.8 pounds) is turned into the jacket covering of the cylinder and maintained for twelve hours, it being a fundamental principle of this system that the heat is applied indirectly and dry, the moist steam never coming in contact with the animal matter. The cylinders are hermetically closed, so that no offensive odors escape, and the whole establishment, although naturally rank and unsavory, is thought to reduce to a minimum the repulsive features of the process.

The economic management of this institution being in private hands, its statistics do not form a part of the public municipal report, but it has been ascertained that the dead horses received there average about three hundred per month, and that during the year from April 1, 1896, to March 31, 1897, there were delivered from the abattoirs 1,337 condemned cattle, 1,488 hogs, 526 calves, and 265 sheep—in all, 3,616 animals, besides portions of carcasses that had been rejected by the meat inspectors.

The advantages claimed for the apparatus with which this work is done are that it utilizes every valuable portion of the animal and that it extracts the fat so successfully that only 10 to 12 per cent of the oleaginous matter remains in the phosphate residue that is used as fertilizing material. The apparatus is, according to the statement of the inventor, so constructed as to apply two new principles to the reduction of animal matter to its elements (gelatin, fat, and nitrogenous waste): First, the steam heat is so applied as to cook and reduce the flesh in its own juices, thus avoiding wasteful dilution with water; second, the condensed water is used directly over and over again with very small loss in temperature and consequent economy of fuel; third, the condensation of the gelatinous vapor in a separate closed reservoir without contact with cold water.

VIENNA.

[From Hon. Alveto S. Hogue, United States Vice-Consul and Deputy Consul-General at Vienna.]

In pursuance of instructions contained in Department dispatch dated June 24, 1899, I beg to report herewith the manner in which the carcasses of dead animals are disposed of at Vienna, namely: (1) The manner of appointing a public flayer; (2) instructions for the public flayer.

Dead animals found within the city limits, after the cause of death is ascertained, are steamed in so-called digesters in the thermochemical establishment, under a pressure of steam of about four atmospheres. The steamed matter is thereby sterilized at the same time. After completed steaming, the resulting fat and limewater are removed from the digester; what remains in the apparatus is dried and worked into meat and bone meal. The products belong to the lessee of the thermochemical plant, who is at the same time the public flayer.

All animals confiscated by the veterinary police and the meat inspectors are treated in a like manner as are the carcasses found in the street. The plant of the public flayer and the thermochemical plant are combined in one and situated at Kaiser Ebersdorf, within the city limits, but isolated and well in the country. The plant is the property of the city and is leased in good running order. The lease was renewed January 1, 1897, and is for five years, the lessee paying \$2,760.00 for the privilege of operating it for the marketable product he obtains resulting from the thermochemical plant. As city public flayer, he is bound by strict conditions to fulfill the duties of that office.

The amount of animal carcasses and offal annually worked up in the public flaying plant is shown by the following table:

Quantity of animal carcasses and offal worked up in the public flaying plant in Vienna, 1894 to 1896.

	1894.	1895.	1896.
Horses, asses, and colts.....head.....	1,038	1,200	1,397
Oxen.....do.....	511	641	671
Calves.....do.....	929	911	717
Sheep, lambs, goats, kids.....do.....	780	927	345
Hogs and pigs.....do.....	3,765	4,355	6,144
Dogs and cats.....do.....	2,632	2,719	3,290
Deer and chamois.....do.....	82	95	111
Wild boars.....do.....	2	1	2
Hares and rabbits.....do.....	729	212	254
Various wild animals.....do.....	6	11	5
Carriage.....pieces.....	34,970	22,473	31,129
Various kinds of meat.....pounds.....	373,032	682,862	587,960
Domestic poultry.....do.....	11,948	8,280	11,772
Game birds.....do.....	9,714	1,408	1,863
Crabs.....do.....	17,877	12,386	15,063
Fish.....do.....	84,330	22,440	21,850

In connection herewith the new plant for the public flaying of carcasses of animals, combined with Podewil's apparatus (flayer's disinfector) for safely reducing the same, at Brunn, Austria, is of public interest. It was constructed by the city in 1898, and is the most complete plant in Austria for the purpose, considered in relation to sanitary and economical principles. It was erected to be in connection with the abattoir now building, and both will be under the same inspection and management. The reasons for joining the plant and the abattoir were both sanitary and economical, because a strict veterinary control is exercised only over the workings of the abattoir, and, besides, most of the material to be destroyed in the disinfecting apparatus comes from thence: further, animals brought by rail to market, if found to be infected with disease, can be delivered directly from the car at the plant without having first to be unloaded, and any such stock driven to market and found infected need not pass by the stock yards. Both buildings are so constructed that the plant may be enlarged in equal degree with any enlargement of the abattoir.

The entire plant consists of three buildings and an open shed, and is surrounded by a solid brick wall. Its shape is a long rectangle from east to west, the dwelling and offices being on the western short side, while the flayer's disinfecting plant forms the northern long side, and the flayer's plant and stables form the southern long side, the open shed forming the eastern short side.

The flayer's disinfecting plant consists for the greater part of the following compartments: Warehouse for the products of the plant (tallow and hides), for disinfecting, butchering, apparatus apartment with warehouse above it for meat guano, boiler house, coal bunker, laboratory, and the loft for utensils, such as machinery and tools.

The plant (system of Podewil) has the following advantages: (1) The entire manipulation consisting of steaming, sterilizing, fat extracting, drying, and pulverizing takes place in one single apparatus, whereby the fat of the carcass is rendered, and this fat itself is put into a marketable product by changing it to meat guano. Repeated transportation of the raw material as also the application of special drying and grinding contrivances are thereby not required. (2) The

strongly nitrogenized meat pulp, a risky article in a sanitary sense, and the liquid waste of the animal carcasses, and the washing water from the butchering room are evaporated to dryness. (3) The grinding takes place at the same time as the drying, during the most favorable period, when the carcass contains the least per cent of liquid. (4) The preliminary process of the rendering is absolutely odorless, because the carcass remains in the air-tight closed apartment till the finish. (5) The apparatus is not only adaptable for carcasses, but also for blood and all kinds of waste of animal origin.

CONSTRUCTION OF DRUMS.

The principal part of the apparatus is a double-sided drum with double arched bottoms resting on two hollow spigots. The gas passes through the spigot of the one side from a pipe made tight with a stuffing box first into the one double bottom, from this into the heating mantle as well as into the other double bottom. The condensed water in the heating mantle is conveyed through a pipe provided with a stuffing box through the same spigot and generally used again in the boiler. Steam can also be let into the interior of the apparatus through a branch pipe. The steam arising in the drum is conveyed through a pipe to the condenser. This pipe is perforated like a sieve, can be turned by means of a crank from the outside, and is connected with a small straining device. This is a hollow free-movable roller in the inside of the drum. All parts of the apparatus are of the best material, the drum being made of carefully welded strong boiler plate and the spigots of forged steel. The cog device for driving the drum is screwed tight to one of the bottoms, so that the spigots are free from torsion. The exterior of the drum is provided with a light covering as a protection against loss of heat.

CONSTRUCTION OF THE SEPARATOR FOR FATS.

The separator for fats consists of a simple vessel which receives the fat and the meat pulp for a short time in order to enable the thorough separation of the fat. The drum is filled with material, the manhole closed, and then the first part of the process is to pump out the air with an air pump. Then the steaming process begins by letting steam into the interior of the drum. The steam is conducted directly into the carcass and heats the same to 160° Celsius. By this intensive procedure nearly all the fat and glue are obtained from the material. The bones are softened, and the sinews and hoofs lose their firmness and in a few hours constitute a pulp. The drum, which up to this time has remained stationary, is made to rotate slowly for a little while. Thereby a mild movement is caused in the mass as long as it is of a nature of pulp, which is necessary to disintegrate the softened pieces and to facilitate the separation of the fat therefrom. The apparatus is then left at rest and the swimming fat is forced through a pipe into the separator. For this process the conducting line to the separator is opened and the pipe is raised by a lever until it touches the upper surface of the fat. The pressure in the drum forces the fat into the separator along with a part of the meat pulp in order to save all the fat. The fat is forced out of the separating vessel by means of a revolving pipe and the meat pulp is forced back into the drum, where it and the remainder of the carcass are easily dried. In the meantime the drum is set in motion and the double mantle, as well as the bottoms, heated by steam for the purpose of drying. The vapors arising during the drying process are conducted by a pipe to the condenser. The steaming in the revolving drum is continued until the matter in the apparatus is converted to a powder by the freely moving roller within it. After complete drying, the manhole is opened, whereupon the apparatus, after 40 revolutions, empties itself automatically. The fertilizing powder is finally thrown through a

grated sieve and the remaining lumps collected and returned to the apparatus, where the process is repeated.

On the basis of statistics it has been computed that there will be 220,000 pounds of carcasses and parts of carcasses to be treated annually. Such a quantity requires continual working of the plant for a rational use thereof, and a daily capacity of 770 pounds of crude material, for which reason a Podewil's apparatus (No. 1) was selected. This apparatus works off this quantity in twelve to fourteen hours, hence it is possible to fill it twice in twenty-four hours; and the plant offers security for even greater demands to be put upon it, as an enlargement of room is allowed for by a suitable construction of storage space for the setting up of a second drum apparatus (No. 1), for which the present driving machine and boiler are sufficiently large. Therefore, by placing a second drum apparatus and working night and day, four times the quantity (880,000 pounds) could be annually handled.

The boiler is arranged for possible enlargement in the first plant for double daily heating—that is, with 11 square yards of firing surface and constructed like Cornwall's steam boiler, with lateral furnace pipe for six atmospheres of pressure above atmospherical pressure. The machine in a lying position is constructed with simple sliding regulator without condensation, with throttle-valve regulator, which in 100 revolutions per minute and 6 atmospheres of boiler tension is equal to 6 to 10 indirect horsepower.

Adjoining the apparatus room is the dissecting room. It is connected with the apparatus room, and the walls of the broad, high, and well-ventilated space are covered to a height of over 2 yards with glazed tiles. The floor is cemented and arranged with the incline toward the middle. At the lowest point a thickly cemented pit is constructed, which may be closed with a movable air-tight cover, to which all the refuse liquids and the rinsing water coming from the dissecting table are conducted. This pit is bailed out every time it is used, and the contents evaporated in the steam apparatus. Watering hose have been provided for the thorough cleansing of this as well as of all other rooms.

The parts of carcasses are sent directly from the dissecting table to the manhole of the flayer-disinfector by means of an iron trough affixed above it through the partition wall, and this trough is afterwards rinsed with water.

In the flayer's building, besides a dwelling consisting of two rooms, a chamber, and a bathroom, there is a cage for healthy dogs, an observation cage for sick and suspected dogs, a stable for the horses belonging to the flayer's building, an observation stable for sick cattle, and a wagon house. All the places destined for the reception of animals are fitted up with water-tight floors and cemented walls, and are provided with a washable coat of oil paint. The dog cages are constructed of iron and wire, and by a sliding door rolling upward or by lifting up the cage roof. The dogs are provided with food and water by means of a feeding trough adjusted to the left side of each cage and moving on a horizontal axis, which trough is turned outward, filled with food, and then turned in again. The bottom and back of the trough while turned outward close the aperture thus made in the cage, so that any injury to the person providing the food is excluded. The entire plant is provided with drainage, but none of the refuse from the dissecting room and laboratory, nor of the quarantine stables, gets into the sewer system. This is collected in pits constructed for the purpose and evaporated to dryness in the Podewil apparatus.

The powder obtained in the flayer's disinfector from the remains of the carcasses is similar to coarse-grained brown garden mold, is but little greasy to the touch, and has no unpleasant odor. On account of its great nutritiousness it is an excellent food for hogs, and has now become so popular that the demand for it far exceeds the quantity produced.

BELGIUM.

[From Hon. George W. Roosevelt, Consul at Brussels, Belgium.]

The minister of agriculture proposes to grant a contract for all Belgium for removing and destroying by a special process dead animals recognized as unfit for consumption. According to the present project elaborated by this department 15 establishments for skinning and destroying animals will be constructed, and later on, if found necessary, the number will be increased.

Each establishment will be furnished with a steam generator and at least one autoclave (digesting furnace), in which animal matter will be destroyed by steam heat at a temperature of about 150° C. This autoclave, built according to the latest improvements, closes hermetically, and is provided on the outside with a manometer and index plate, permitting a view of a process of operation. The gases produced in the autoclave are carried by means of appropriate pipes into the furnace of the generator, where they are completely burnt and destroyed. The skinning plants will be provided with necessary arrangement and instruments for handling and cutting dead animals, as well as with apparatus well provided to collect the subproducts. The products of incineration do not emit any pernicious odor after operation. The matters very rich in phosphates will be sold and utilized as fertilizers.

The diseases which will necessitate the destruction of the bodies of animals are glanders and farcy in horses, mules, and donkeys; contagious pleuropneumonia, typhus, and anthrax in cattle, sheep, and horses; and tuberculosis in cattle. Such carcasses as are actually intended to be sterilized in special works authorized by the Government are excepted. Meat coming from such bodies is considered fit for consumption after sterilization.

BRUSSELS.

[From Hon. George W. Roosevelt, Consul-General at Brussels, Belgium.]

It is customary in this consular district that dead animals, especially horses, are disposed of by sale by their owners. Dead cats and dogs are thrown into the garbage boxes and removed, as well as such as may be found on the public highways, by the scavenger carts. Frequently the skins are removed and sold by the scavengers and the carcasses incinerated or dumped on the garbage farm. Abandoned dead horses and cows are removed to an inclosure set apart for the purpose of skinning dead animals. After the skin is removed the carcass is destroyed by sulphuric acid and the refuse reduced to powder and used in making chemical fertilizers.

The following is a translation of an extract from the police regulations of May 20, 1874, relative to the disposal of carcasses of dead animals:

ARTICLE 129. Dead animals shall be immediately buried. Such as die from disease recognized or suspected as contagious must be buried in trenches 2 meters [6.56 feet] deep and at least 100 meters [328 feet] distant from any habitation. Others in trenches 1½ meters [4.92 feet] and at a distance of at least 75 meters [246 feet] from any habitation. The ground for this purpose is always designated by the commissary of police. In case of infraction of this law the communal administration will order the disposal of the dead animal at the expense of the offender, independent of fines mentioned in the present regulations.

ARTICLE 130. It is forbidden to skin dead animals within a distance less than 300 meters [984 feet] of any habitation or public road. Before skinning animals the knackers must, on each occasion, make declaration before the commissary of police. The carcass of the animal will be taken to a designated place and immediately interred.

ARTICLE 131. The removal of dead animals, such as horses, cows, calves, asses, or mules, to be effected by means of covered carts.

ARTICLE 516. Violations of the present regulations, for which the law does not prescribe any special penalties, will be punished by a fine from 1 to 25 francs [\$0.193 to \$4.825], with imprisonment from 1 to 7 days, or by one of the aforesaid penalties only.

The following regulations were issued on July 3, 1899, by Léon De Bruyn, minister of agriculture and public works, of Belgium:

SCHEDULE OF DIRECTIONS, PROVISIONS, AND CONDITIONS IMPOSED UNDER THE CONTRACT FOR THE REMOVAL AND DESTRUCTION OF BODIES OF DEAD ANIMALS KNOWN TO BE UNFIT FOR CONSUMPTION BECAUSE OF CONTAGIOUS DISEASES.

The minister of agriculture and public works will publicly award the contract, under reservation of the approval of the legislature, in case of the continuance of the agreement, the 21st of August, 1899, at 11 o'clock a. m., on the premises of the minister of agriculture and public works at Brussels, for the undertaking of the removal throughout the country and destruction of the bodies of dead animals found to be unfit for consumption because of contagious diseases. The enterprise will be conducted under the conditions and restrictions hereinafter defined:

SECTION 1.—*Removal and transportation of bodies of dead animals.*

ARTICLE 1. The contract comprises the removal, the transportation, and the destruction of the carcasses found to be totally unfit for consumption because of diseases hereafter designated, with the exception always of the animals which the owners should remove and destroy in the regularly authorized inclosures other than those included in section 2.

These diseases are: (1) glanders and farcy in the horse, the ass, mule, and donkey; (2) contagious pleuropneumonia in bovines; (3) contagious typhus in the ruminants; (4) anthrax in cattle, sheep, and horses; (5) tuberculosis in bovines, except in case of carcasses regularly designed to be sterilized in the authorized works for this purpose and to be consumed after sterilization; (6) any other disease which may be hereafter designated by the minister as coming under the application of this article.

ARTICLE 2. The transportation of the bodies to the inclosures where they are to be destroyed should be performed with the shortest possible delay, and in all cases as follows: (a) Within twenty-four hours after the receipt of the notice for removal in case of its being animals affected by bacterial carbuncle (anthrax), and (b) within thirty-six hours after the receipt of the notice for removal in case of all other diseases.

Sundays and holidays are not included in the delay, but the contractor is bound to take measures to prevent the removal of the carcasses by any persons not authorized to do this work. The notices are given by the mayor of the place where the bodies are found by telegram in the first case (see a), and by postal card or letter in the second case (see b). The cost of the telegram is upon the contractor.

ARTICLE 3. The transportation of the bodies must be made in receptacles which are perfectly waterproof. These receptacles must be accepted by an agent of the minister of agriculture. Each of these receptacles will be furnished with a plaque showing that it is accepted, and also its weight when empty. In case of damage to any of the receptacles the contractor is held to employ every necessary means to absolutely avoid the running or escaping of the liquids.

ARTICLE 4. The bodies removed in pursuance of this contract must be acknowledged by the contractor or his agent. This acknowledgment is to be given to the mayor of the place from which the removal is made by means of a certificate detached from a register. This book is furnished by the department of agriculture and kept in conformity with instructions of the minister.

There will be as many of these books kept as there are inclosures in the execution of section 2, and, besides, a duplicate of each of these books must be kept at the office of each inclosure.

ARTICLE 5. After having acknowledged and given a receipt for the bodies, as explained in the preceding article, the contractor or his agent is required to per-

form the disinfection by means of a solution of *acide phenique* (carbolic acid) or creoline (?), or any other substance which is accepted by the minister.

The removal of the bodies is made under the responsibility of the contractor. The bodies must be taken directly to the respective inclosures, the delay not exceeding the normal time required by the method adopted by the contractor. The time is reckoned from the moment when the bodies are put into possession of the contractor. The register shows the hour of leaving and the hour of arriving at the inclosure.

ARTICLE 6. In case of loss by theft or otherwise of all or part of a body, or in case of refusal on the part of the owner of the animals to allow their removal to the inclosure belonging to the contractor, he or his agent shall make an official report according to the formula furnished by the minister of agriculture. A copy of this report is left with the mayor and another copy is addressed to the veterinary inspector in the district where the animals are found. In case of the partial removal, the report must be accompanied by the statement of weight mentioned in article 10. These official reports are noted in the registers.

ARTICLE 7. The department of agriculture can not be held responsible for any of the consequences resulting to the contractor under the preceding article. This will be the same in cases resulting from the absence or late delivery of the notices referred to in article 2.

ARTICLE 8. In case of delay in removal or transportation of the animals the contractor is liable to a fine of 50 francs.

ARTICLE 9. In case of loss, from any cause whatever, of all or part of a body for which a receipt has been regularly given by the contractor or by his agent, in conformity to articles 5 and 6, the contractor is liable to a fine of which the sum is to be adjudged by a competent veterinarian, shall not surpass 500 francs, and this without prejudice to the provisions of article 19.

ARTICLE 10. On arrival at the inclosure the carcass is weighed by an agent who is under oath for this purpose. The weighing is done according to the instructions of the minister by means of automatic weighing machines which register the weight, this being verified exactly by an agent of the minister.

The bulletin of weight of each animal, as well as all the instructions by the minister, must be supplied through the care of the contractor under a competent veterinary inspection within two days after the arrival of the carcass in the inclosure.

SECTION 2.—*The organization of the inclosures and destruction of the carcasses.*

ARTICLE 11. The destruction of the bodies shall be performed in fifteen inclosures for skinning and cutting up, and shall be established within the limits prescribed by the minister. The number of inclosures may be extended to seventeen if the minister finds it necessary. The site for these last inclosures shall be chosen in the same manner. The management of these inclosures must be made conformable to the regulations upon that subject.

ARTICLE 12. The products of the bodies and parts of bodies destroyed within these inclosures are the property of the contractor.

ARTICLE 13. The minister will indicate, in accordance with the localities where the carcasses are found, the inclosures to which they should be transported.

ARTICLE 14. Each inclosure must contain a steam generator and at least one autoclave, in which the animal matter is destroyed by steam at a temperature of about 150°. This autoclave should be constructed according to the systematic rules—closing hermetically and being furnished on the exterior with a manometer as well as apparatus indicating the progress of the operation. The gases produced in the autoclave should be completely burned in the furnace of the generator, to which they will be conducted by suitable tubes.

ARTICLE 15. Each inclosure should be provided with appliances and the necessary implements for the manipulation of the cutting up of the bodies as well as suitable apparatus for collecting the subproducts. The bodies are cut and separated in the receptacles in which they were brought, and emptied directly into the autoclave from these receptacles. The cutting up of the bodies affected with anthrax should be done by workmen who are furnished with special gloves.

ARTICLE 16. The animals brought to the inclosures and there held under control of the Government veterinary inspectors should be retained, subject to directions of the minister. The contractor must conform to the instructions given by the inspectors as to the final preservation of all or parts of the bodies. After the delays indicated by the minister the bodies are immediately placed in the autoclaves.

ARTICLE 17. The fats obtained through the treatment of the bodies are reduced by means of processes accepted by the minister. The storage places of any sort of matter taken from the autoclaves should be free from any disagreeable odor.

ARTICLE 18. The minister reserves the right to cause the replacing at any time of all or a part of the material of the inclosure and of the means of transportation which may appear improper for the service or defective in any way in whatever connection it may be. The contractor should always arrange for at least two extra autoclaves for the purpose of being certain of their service in the different inclosures. He should also extend and increase his material and develop his working force in keeping with the needs of the service.

ARTICLE 19. In the case where the minister or his delegate finds, after two consecutive notices, that the material for the work of the inclosure is insufficient or defective, the minister can, after a simple legal process, cancel the contract and resort to a new adjudication. The same measures can be taken in the case where the contractor or his agents are guilty of removing meats intended to be destroyed in the inclosure.

ARTICLE 20. The contractor obligates himself to have constantly at his command the necessary personnel to promptly effect the removal as well as the destruction of the carcasses. This personnel should include one person capable of making the estimates provided for in article 30 of the regulations, concerning tuberculosis in bovines, and the minister reserves the right to accept for that purpose according to his pleasure.

The employees in the inclosures should be insured against accidents. They are required to always observe the greatest politeness toward the public.

The agents charged with the removal of the bodies are obliged to wear in this service a cap bearing an insignia conforming to a model selected by the minister.

ARTICLE 21. The minister reserves the right to accept the personnel employed in the inclosures and to require the dismissal of those who may have committed infractions of the stipulations under the present agreement or of the rules connected with the material.

ARTICLE 22. In case of repeated delays or of serious negligence on the part of the contractor in the removal or the destruction of the bodies, the minister can, by virtue of his office, and at the expense of the contractor, take such measures as seem to be necessary (without previously entering suit) to assure the service thus left in neglect.

ARTICLE 23. The contractor is obliged to keep a daybook in each inclosure, besides the register, which is furnished him by the department of agriculture in which he shall record: (1) The contents of each autoclave, designating the animals which are put into them for the purpose of destruction. (For the description of the animals the contractor refers to the register.) (2) The exact quantity (weight and volume) of the products (fats and grease) extracted from the autoclaves. All false entries or errors made in these daybooks or in the register will be punished by a fine of 50 francs.

ARTICLE 24. The contractor is bound to conform to all the measures which the minister may be led to take for the certainty of the removal, the transportation, and the destruction of the bodies of the animals. He is likewise bound to conform to the orders of the sanitary police regarding the domestic animals, and those which relate to the granting of indemnities for animals slaughtered or seized by order of the authorities.

ARTICLE 25. The contractor must also permit the delegates from the department of agriculture to take samples of the products obtained in the inclosures and authorize such trials or experiments as the minister may judge useful to make there, at the expense of the department of agriculture.

ARTICLE 26. The Government can not be held to intervene in any manner in the payment of the costs and damages to which the contractor may be subjected by the chief of the operations in the inclosures.

SECTION 3.—*General conditions.*

ARTICLE 27. The sums due by the department of agriculture will be liquidated according to the statute controlling the accounts of the State—every three months—upon the balance sheet prepared by the contractor.

ARTICLE 28. The contractor can not give up his contract in full nor in part without the express authority of the minister.

ARTICLE 29. In case of the decease or the bankruptcy of the contractor the contract is canceled legally. The minister reserves the right to accept, if it seems to him proper, the offers which may be eventually made to him by the heirs or the creditors for the continuation of the enterprise.

ARTICLE 30. No one shall be admitted to take part in the adjudication of contracts who has not previously deposited in the hands of the Government cashier, at the national bank or at one of its agencies, a bond amounting to 2,000 francs. He who makes a proposal joins to his proposition a certificate of deposit which has been delivered to him by the cashier after having the coupon detached by the agent of the treasury. The sum deposited by the one upon whom the enterprise devolves will be increased by a second sum of 8,000 francs and will be held as security. The return of previous deposits will be made within eight days.

ARTICLE 31. The minister reserves the right to take or cause to be taken, amicably or upon estimates of experts, at the expiration of a contract or on the canceling thereof provided in article 19, the works and appliances which remain in condition to be utilized, the retiring contractor engaging to deliver them for further use in the same enterprise.

The minister or his delegates shall alone judge of the possibility of utilizing in the new operation these appliances and materials and the contractor can not in any case raise any claim thereto.

ARTICLE 32. The minister reserves the right also to cancel the existing contract at any time, under the circumstances provided for in the preceding article, by means of an indemnity equal to the sum paid by the Government to the contractor the previous year for the transportation and destruction of the bodies of animals.

ARTICLE 33. The value of the ground and of the material to be taken back is determined by counter estimates made by two delegates representing the one the contractor who is retiring, and the other, as the case may be, either the minister or the new contractor. In case of disagreement between the two delegates a third shall be appointed by the president of the tribunal of the first process, at the request of the first party applying. The sum fixed upon for the above must be paid to the claimants within thirty days from the closing of the process of evaluation. In case of delay in the payment the sum is increased by the charging of interest at 4 per cent per annum, running from the expiration of the allowance of thirty days to the date of the payment, and this without prejudice as to the

liability of the delinquent for all costs and damages if the delay is prolonged beyond a second period of thirty days.

ARTICLE 34. For the purpose of assuring the regular progress of the service after the expiration of the contract, or its cancellation (or annulment) for any reason whatsoever, the minister reserves the right to take temporary possession of the premises as well as of all or a part of the operating machinery, the control of the personnel, the means of transportation, and the material of the contractor, leaving for the estimate of experts the sum to pay to this chief.

ARTICLE 35. All the taxes of any sort imposed or to be imposed either upon the real estate occupied or upon the means of transportation to be furnished are at the exclusive charge of the contractor.

The taxes upon circulation of any kind, such as entrance duty, bridge toll, etc., all devolve upon the contractor.

ARTICLE 36. Within a month from the day of his accepting the commission the contractor is bound to enter the requests for authority to construct the inclosures. The works must be completely furnished, fitted out, and ready to operate in the five months following the dates of the demand for authority, under a penalty of paying 100 francs per day for the delay in operating.

ARTICLE 37. The duration of a contract is ten years, counting from the sixth month which follows the date of the acceptance of the contract.

ARTICLE 38. The contractor can not in any case or under any pretext make any demand for indemnity from the authorities for ignorance of the conditions and restrictions which are given publicity in this pamphlet of instructions.

Manner of awarding.

The awards will be adjudicated through the submission of sealed applications drawn up after the model hereto annexed.

The bids should be addressed to the director-general of agriculture, 3 rue Beyaert at Brussels, by registered letter, which shall be posted the 18th of August at the latest, or should be placed in the hands of this official or his substitute on the 19th day of August at the latest, before 4 o'clock in the afternoon. No one will be allowed to enter a bid after this date.

The bidder must indicate exactly, in all cases, the prices at which he will undertake to perform, according to the directions and conditions of this present schedule, the removal and transportation, also the destruction, of the carcasses of animals in compliance with article 1.

This price constitutes a contract applicable to each animal under pain of forfeiture.

During the continuance of this contract he can not be paid by the Government any premium for the removal and destruction of any animals whatever excepting in the service of the inclosures as provided for in article 2. The bidders should be well known and should present guaranties of their solvency before being accepted as contractors.

The bids which are not in the form of the annexed model or which include other conditions than those which are here stipulated, as well as those to which the author's neglect to add the certificate of deposit or bond as preliminary security or other securities to take the place of these, will be rejected.

On the 21st of August, 1899, at 11 o'clock a. m., the official designated to preside at the awarding of contracts, or his substitute, assisted by the veterinary inspector of the department of agriculture, will proceed to open the envelopes containing the bids. The bidders are admitted to the room where the awards are made. The presiding officer will announce the names of the competitors and the prices at which they propose to operate the removal, the transportation, and the destruction of the animals designated in article 1.

When the most advantageous offer has been made by two or more bidders, and these are present, they are invited to deposit immediately in writing a new offer lower than the preceding.

If the said competitors do not deposit any new bids, or if the second trial shows a continuance of parity in the prices, or finally if one of the bidders is absent, the process of casting lots will be proceeded with in continuous session. The new offers should be written on plain paper, except it must bear the stamp of approval within twenty-four hours at the expense of the competitors.

The minister has the right to choose between the bids deposited, as well as the right not to give his recognition of the awards, and to order a new trial, or to take such other measures as he may judge to be for the interest of the state. The decision to be made upon the result of the competition will be given within one month following the date of the adjudication if, for this date, the courts have modified article 19 of the law upon the responsibility of the state.

The recording of the bid at a fixed price is charged to the contractor.

Form of competitive bid.

I, the undersigned [name and Christian name], residing at — street —, No. —, having informed myself through the pamphlet on directions and conditions imposed under a contract for the removal, transportation, and destruction of the bodies of animals known to be unfit for consumption because of diseases indicated in said book of instructions, do engage, promise, and agree, by this present, upon my goods and property, personal and real, to execute the service conformably to the clauses and conditions therein enumerated for the State, and to pay — francs [both in writing and in figures] per each body removed, transported, and destroyed in the inclosure established by me or at my cost.

In cases where the number of animals to be transported and destroyed shall be less annually than 3,500, the price indicated above will be increased 10 per cent in a ratio of each 300 bodies or less to transport and destroy. This price, however, can not be increased more than one-half.

Done at —, —, 1899.

— [the competitor.]

Notice.

The representatives of societies, companies, or of private individuals furnished with sufficient authority to treat in the name of these societies, companies, or private individuals, should formulate their propositions in such a way as to show that it is these societies, companies, or private individuals themselves who make the engagement to perform the obligations.

The persons who take part in the bidding through the authorization of a third party should be prepared to exhibit their commission to the official who presides at the meeting. If the bid is sent by post, a copy of the commission, properly certified, should be attached. The form of the commission, in this case, may be drawn up in the following terms:

I [we], the undersigned [managing director or president or administrator, delegate, or proxy, etc.], of [here note the company or the name, forename, and dwelling place of the principal], being duly commissioned to this effect, and having informed myself, etc. [as above], by this present, etc., for [indicate the society, the company, etc.], do hereby engage, promise, and agree, etc.

STOCKHOLM.

[From Hon. Edward D. Winslow, Consul-General at Stockholm, Sweden.]

All carcasses of animals found dead or of animals which are slaughtered because of injuries are sent to the veterinary institution of this city, where they

AMSTERDAM.

[From Hon. A. Vinke, Vice and Deputy Consul at Amsterdam.]

carcasses of dead animals are burned in an oven at the plant of said service. muzzled dogs running in the streets are caught by the police, and, when not claimed by their owners within four days, are killed and cremated in this oven.

HOG RAISING IN THE SOUTH.¹

S. M. TRACY, M. S.,

Formerly Director of the Mississippi Agricultural Experiment Station.

In the Southern States more pounds of pork are used than of all other meats combined. In a large proportion of the country homes beef and mutton are practically unknown, excepting occasionally in the winter months, and pork is almost the only meat food used by the large colored population. In every country store salt meat is as staple an article as is sugar or coffee; its cost is an important item of expense to the majority of housekeepers, and the demand for it seems limited only by the ability to purchase. Ten years ago fully 90 per cent of the pork used in the Gulf States was shipped from the great packing houses in Kansas City, Chicago, and Cincinnati, and little attention was given to its production here, few farmers growing even enough for their own consumption.

Since 1890, however, there has been a rapid increase in the number of hogs raised, a corresponding decrease in the amount of pork imported, and a still greater decrease in the living expenses of those who raise their own supply. Those who have engaged in raising hogs for the market have found it very profitable when rightly managed, and at the present time the business of raising hogs is increasing more rapidly than any other line of stock raising in the South. Conditions—climate, pastures, and grain feeds—are so different from those in the older hog-raising sections of the country that this bulletin has been prepared to describe some of the more economical methods peculiar to this region, as well as to give some general principles of breeding and management for those who have had but little experience in the work.

GENERAL CONDITIONS.

The hog is often called the “mortgage lifter” of the great corn belt from Ohio to Kansas, but its power in this direction is by no means confined to the region of cheap corn. The Southern States can produce corn almost if not quite as cheaply as the most favored regions of Illinois or Missouri, while the much greater variety of food crops, the more nearly continuous grazing, and the consequent greater immunity from disease give special advantages for profitable pork rais-

¹ Published also as *Farmers' Bulletin* No. 100.

ing which do not exist elsewhere. Profit from the raising of hogs depends more on the supply of cheaply grown feed than on any other item. Food crops which are inexpensive to grow, which mature at different seasons, and which can be harvested by the hogs themselves are abundant in all parts of the South; and there is no reason why the Southern States should not be exporters instead of importers of meat.

LOCATION AND WATER SUPPLY.

For successful hog raising almost any location is suitable where there is a fertile soil on which food crops can be grown at a small expense and where an abundant supply of pure water can be secured. A good spring or a small running stream which is not contaminated by drainage furnishes the best possible water supply. A large stream is undesirable, as it makes it difficult to keep the hogs fenced in, causes frequent losses by overflows, and often brings germs of disease from points nearer its source. The last objection is the strongest of all, as the germs of anthrax, cholera, swine plague, and other contagious diseases are often carried long distances by water, and such a possible source of infection should be carefully avoided. This spreading of disease by means of running water has been very plainly marked in nearly every outbreak of cholera in the hog-raising sections of the North, and though the disease is comparatively rare in the South, still it occurs occasionally, and its spread should be prevented by the use of every available means.

Shallow, stagnant ponds, in which the hogs are allowed to wallow, are equally undesirable and should never be tolerated. It is true that such ponds are in very common use and that many fine hogs are raised with no other water supply; but it is also true that such pools are always disease-spreading centers and are often responsible for serious losses which are attributed to cholera. No animal can be healthy or produce meat of the best quality when compelled to drink the putrid offal with which such ponds are always poisoned. Where a pond is the only available source for the water supply, it should be fenced so that neither cattle nor hogs can reach it, and the water should be drawn off into an outside trough as it is wanted. It is a small matter to provide for this when a dam is built by having a 1-inch galvanized-iron pipe laid through the bottom of the dam. The end of the pipe in the pond should be protected by a large strainer, and the outlet provided with an automatic float valve so that the trough will always be kept full; no water will be wasted, and a fresh supply will be drawn in as fast as the trough is emptied. The whole arrangement can be made at an expense of not exceeding \$5, the value of a single half-grown hog, and will often save many times its cost in a single season.

It is not necessary that hogs should be provided with a place for wallowing in mud, as they will seldom wallow except when suffering from heat. A hog does not perspire freely, and so feels the effects of

heat very quickly. When the only means for protection from the hot sun is to bury himself in mud, he will naturally do so. In the shade of a building he often misses the breeze, but in the shade of trees he will always be contented. An abundant supply of water and protection from the hot sun are both necessary, but should never be combined. With shade and good water provided, the other details of the location are of minor importance.

BUILDINGS AND FEED LOTS.

Elaborate and costly buildings are not needed, and, in fact, should be avoided. In the South it is rarely necessary to protect from cold, and all that is needed in the way of a building is something to furnish shelter from rain and a dry place in which the hogs can eat and sleep. Ordinarily a shed 8 by 10 feet, open on the south side, is all that will be wanted. This shed need not be more than 3 feet high at the back and 6 feet at the front, and should be floored. If the arrangement of other buildings is such that it is more convenient to feed from the south side, then that side should be closed by slats sufficient to control the hogs, but not close enough to shut out the sun and air, and at least one-half of the north side should be left open. In all cases the floor should be given a slope of at least 2 inches to the side opposite the feed trough to prevent the accumulation of filth. Such a shelter is ample for at least a dozen hogs, and when more are kept it is better to have additional separate shelters than to attempt keeping a larger drove in a single large building. Hogs always do better in small droves than when many are kept in one inclosure. Rough planks are all that is needed for the floor, as its main object is to prevent the hogs making a dirt floor into a dust bed, which, next to impure water, is the most prolific cause of disease.

At the rear of each house there should be a yard large enough to give ample room for exercise, and if there is a number of these yards they should be arranged so that they can be thrown together and the hogs easily changed from one to another when desired. Whatever may be the arrangement of the yards, they should be surrounded by a fence so well made that it will offer no temptation to the most knowing animal. A hog which has never broken through a fence will seldom attempt to get out of his lot and will give very little trouble, but if he is permitted to break out a few times he will know that a fresh pasture and a change of feed are just on the other side of the fence, and will soon learn to go where he pleases.

BREEDS AND BREEDING.

The choice among different breeds is more a matter of personal preference on the part of the hog raiser than of real superiority in any one breed of hogs. Each has its peculiarities, its excellences, and its defects, and it can not be said that any one of them is always more

profitable than another. Management and feed are more important than breed, and the choice should be decided by the treatment to be given.

SELECTION OF A BREED.

The more common breeds in this country are the Berkshires, Poland-Chinas, Chester-Whites, and Duroc-Jerseys, though Essexes, Suffolks, and a few others are occasionally seen. Thirty years ago the differences between different breeds were very marked, but with the greater attention which breeders have given to the production of animals possessing an ideal form the characteristics of the different breeds have approached each other until now nearly all breeds have the same general form. Value in a hog of any breed is measured by his ability to make good pork, and experience has shown that, ordinarily, good pork can be produced more cheaply in a hog of a certain shape than in one which differs from the type to any great extent.

The perfect hog.—The outline of a perfect hog, when viewed from any direction, should be nearly that of a parallelogram with the corners slightly rounded. His back and belly, also his sides, should be straight and parallel; and, when viewed from front or rear, his outline should be nearly square, but a little deeper than wide. The head should be short; the face straight or somewhat dished, and wide between the eyes; the ears should not be too large, should be thin, soft, and joined to the head by a small knuck. A large, coarse ear usually indicates a coarse animal which will fatten slowly. The jowl should be full, well rounded at the sides, and making a straight line from the tip of the lower jaw to the point of the breastbone. The neck should be short (the shorter the better), but well rounded, arched, and increasing in size from the head to the shoulders. The shoulders should be full and square, with the legs set well apart so as to afford ample room for the lungs and heart, and the heart girth just behind the shoulders should be nearly equal to the girth at any other point. The back should be broad and straight, and should be slightly arched rather than swayed between the shoulders and hams. The ribs should be well sprung to make the back broad, and should drop nearly straight at the sides. The belly should be wide and straight, not flabby nor drawn in at the flanks. The hams should be as wide as the shoulders, nearly flat across the top, and drooping but little to the root of the tail; they should be well rounded behind and come well down on the stifle, so as to make the lower part of the ham full and plump. The legs should be short, straight, set well apart, and strong enough so that the animal, even when well grown, will walk wholly on his feet and not upon his hocks and dew claws. The bristles should be fine, soft, and sufficiently thick to hide the skin. Coarse, stiff, erect bristles indicate a coarse animal which will mature late and unsatisfactorily, while if they are so few and short as to show the skin plainly they indicate a weak constitution and consequent liability to disease.

Color has but little to do with the value of an animal, though there is a general prejudice in favor of black hogs for a warm climate. Buyers seldom make any difference in price on account of color, though there is usually a special demand for a few fancy white hogs about Christmas; but the scalding and scraping must be very carefully done or the skin will be reddened and so injure the sale in the local market. Packers pay no attention to color. The disposition of the hog should also be considered. An animal which is always uneasy, which is continually trying to escape from the lot, and which is inclined to fight and worry others, is too nervous to be a good feeder; on the other hand, a hog with too much of the opposite character, one which is rarely on his feet except while eating the food brought to him, will fail to make a satisfactory growth on pasture and will not take enough exercise for health. A medium between these extremes is a much better feeder than either.

The Berkshires.—The Berkshire is one of the oldest breeds, and one of the most popular in all parts of the South. Berkshires are of English origin, and were first brought to this country about 1830. They may be put in good condition for killing before they are six months old, but will continue to gain in weight until they are two years or more of age. They are good "rustlers" and will make a large part of their living in the pasture, but respond quickly to fattening food. They lose less in dressing than do most others, though a slightly greater proportion of their dressed weight consists of fat, which is better for making lard than for use on the table. The sows are very prolific and good mothers.

The Poland-Chinas.—The Poland-Chinas are the more popular breed in the corn belt of the North, and are about as numerous as the Berkshires in the South. They are a composite breed of recent origin which seems to have been developed naturally by the conditions existing in a region where corn forms almost the entire food. They originated in Ohio from miscellaneous crosses of the Big China, Irish Grazer, Poland, Byfield, and perhaps other stocks. The name of Poland-China was given about 1840 to a large, coarse black and white hog requiring about two years to mature, but growing to an enormous size, animals weighing 600 to 800 pounds not being uncommon. Crossing of these with Berkshires gave a smaller, finer, smoother, and earlier-maturing animal, closely approaching the Berkshire in form and color but still retaining a great part of its power of continuous growth up to three or four years of age, and dressing out a carcass nearly all of which is merchantable meat. While not as good grazers as the Berkshires, nor as well able to take care of themselves when turned into the woods, the Poland-Chinas of the present day have a quiet disposition, are easily controlled, grow rapidly, and fatten quickly. They appear to bear close confinement rather better than the Berkshires, and so are often preferred for pen raising. Usually

the sows are not quite so prolific as the Berkshires, though some strains are very fertile breeders.

The Duroc-Jerseys.—The Duroc-Jerseys are large, long-bodied, red hogs, which are good feeders, easily fattened, and grow very rapidly when well fed. They have come into prominence during the last fifteen years, being descendants of the Jersey Red and the Duroc breeds, which have long been popular in Pennsylvania, New Jersey, and New York. The blending of the two has produced an animal which is easily kept or fattened, is small boned, vigorous, and prolific. Being very long bodied, the proportion of side meat to ham and shoulders is larger than in most other breeds, but many regard this as an advantage, and the breed is growing in favor wherever it has been introduced.

The Chester-Whites.—These are undoubtedly the most popular of the white breeds. They take their name from Chester County, Pa., where they originated by crossing the native white hogs with some large white hogs brought from England about 1825. Selection from the offspring of those crosses has made a great improvement on the form of the earlier animals, and has developed a hog quite similar to the Poland-China in shape, and differing from that breed but little excepting in color. Where any white hog is to be grown, this is the best for general purposes.

The Essex.—This is a small black hog, of English origin, and is valued more for its quiet disposition, rapid growth when young, and early maturity than for its size or its ability to produce a large amount of meat. Where there is a local demand for well-matured hogs of small or medium size, or for pigs of which one or two are to be kept in a small pen and fed principally on slops from the house and the refuse from the garden, the Essex is a valuable animal, but is not generally popular for ordinary farm purposes, or for making large amounts of pork under ordinary conditions.

Other breeds.—The small Yorkshires, Suffolks, Victorias, and perhaps other breeds are seen occasionally, but probably nine-tenths of the pure-bred hogs now in the South are either Berkshires or Poland-Chinas. The small breeds—Essex, Suffolk, and others—have never been popular in the South, as they reach a weight of 200 pounds little sooner than do animals of the larger breeds, while the latter, if allowed to live, will continue to gain in weight long after the others have ceased to grow.

As showing that there is practically very little difference in the meat-producing capacities of different breeds, Professor Henry, of the Wisconsin Experiment Station,¹ reports a test extending through two hundred and twenty-four days with a Berkshire boar and four sows, together with a similar lot of Poland-Chinas. The total gains

¹ Henry: Feeds and Feeding, p. 551.

and the amount of feed required for each 100 pounds of gain were as follows:

	Berkshires.	Poland-Chinas.
	<i>Pounds.</i>	<i>Pounds.</i>
Total gain of lot.....	1,167	1,168
Feed for 100 pounds of gain.....	512	524

The Poland-Chinas gained 1 pound more than the Berkshires and ate 12 pounds more grain for each 100 pounds of gain, but these differences are so slight that they can not be ascribed to the difference in breed, being more probably due to the individualities of the animals used. Many similar tests have been made at other experiment stations, but with no uniformity in results either in actual gains or in the amounts of feed required; hence it is safe to conclude that differences in breed are more in form, disposition, and habits than in food requirements.

PURE-BLOODS, CROSSES, AND GRADES.

Whether it is most profitable to raise pure-bloods, crosses, or grades is a matter which is much discussed, but which can not be definitely settled in favor of either class for all cases.

Pure-bloods.—In general, good pure-blood animals of any preferred breed will be found more profitable than either crosses or grades, though a poor specimen of a pure-blood animal is no better than any other poor animal. The fact that an animal has a long pedigree and is registered in a herdbook does not in itself make the animal desirable as a breeder or profitable as a feeder. A desirable breeding animal must not only have the prepotency developed by generations of breeding to a certain definite standard, but must also have the form and characters of that standard in a sufficient degree so that it is itself a good specimen of the breed. Hogs are used for nothing except for the making of pork. The pure-bloods have been bred for many generations for that sole purpose. The best animals—those which had the ability to make a pound of meat from the least food in the shortest time—in each generation have been selected as breeders, while inferior ones have been rejected. In this way the natural tendency of the pure-blood animals of to-day has become so fixed by generations of selection that they make a rapid growth from a small amount of food. The “scrub,” on the other hand, has been bred for the development of an animal which would, to a large extent, care for itself, while quick growth, good form, and easy fattening have been neglected, and the animal is to-day but little different from his wild ancestor. It has been literally “root, hog, or die,” and the rooting form has been developed at the expense of the hams and side meat. When given an equal amount of food, the pure-blood will weigh fully twice as much as the native hog at six months or more, and when slaugh-

tered will lose only 20 to 25 per cent of its live weight, while the native will not ordinarily dress more than two-thirds of its live weight. As the pure-blood will make more meat from the same amount of food and in less time than the scrub, it is the better animal.

Crosses.—It is a prevalent idea that crosses make better animals than pure-bloods. It is argued that as Berkshires and Poland-Chinas are each good, a cross will possess the special good qualities of both, and so will be better than either. The crossing of two pure-blood animals of different breeds often gives pigs which are fine animals, have good forms, and will mature quickly and satisfactorily. When a litter of pigs is to be raised exclusively for slaughter, such crossing is not objectionable, and many careful hog raisers think it the better practice; but the pigs from such crosses, however good they may be, are of little value as breeders. The pure-blood ancestors on both sides have been developed toward certain definite but different ideals. In the first cross there seems to be a blending of the two types, and the results are often very satisfactory, but the offspring of these crosses are almost sure to show all the weaknesses and defects of both lines of ancestors as well as many of their own. Breeding from crosses, even though the individual animals may be of good quality, is rarely satisfactory or profitable.

Grades.—Good grades are much more reliable breeders than are crosses and are to be preferred. The native stock has the vigor of constitution, which is always necessary, and has no inherited propensity to develop in any certain direction. When mated with a pure-blood, the result is usually an animal with the vigor of the native ancestor and the characteristics of the pure-blood parent shown in its better form and fattening qualities. Succeeding crosses in the same direction strengthen this tendency toward improvement. The great objection to "grading up" in this way is the fact that, no matter how fine specimens the animals may be, they can never be sold as pure-bloods, and an animal which is a grade will never sell for breeding at as high a price as will one which is of pure blood and entitled to registration. The man who intends to follow hog raising as a business, even if he does not keep more than a dozen animals, will find it both profitable and economical to buy a pair of pure-bloods, and then make his entire drove pure-bloods as soon as he can raise enough desirable animals. By buying a young boar and a sow already in pig by a boar not related to the one purchased, the boar can be used on the offspring of the pure-blood sow as well as upon the grades or natives in the herd, and in this way the pure-bloods can be increased so rapidly that there will soon be no need to keep the grades. The hog raiser should certainly use a pure-blood boar, and it will usually pay to buy a new one each year, so that inbreeding may be avoided. Pure-blood hogs are not necessarily expensive. They pay best in the end, and so are more profitable than either crosses or grades. Good animals, though not the best,

of any of the standard breeds can be purchased for from \$5 to \$10 each when weaned, while young sows in pig can be bought for from \$10 to \$20. Of course older animals which show specially fine qualities will cost more, and their better qualities will often make them the more profitable in the end. Breeders who have established reputations as producers of exceptionally fine animals usually receive much higher prices than those named above, but often a man who raises hogs for production of pork only, and who does not care for a reputation as a breeder, will sell good breeding animals for little more than their pork value.

THE BOAR AND HIS TREATMENT.

Hogs intended for breeding should be selected from the very best in the drove. No one can afford to raise pigs from animals which refuse to fatten, which are frequently "off their feed," or which have in any way shown anything but the most vigorous health. The breeders should be the squarest built and best shaped animals in the lot. They should be hearty eaters, and should show a tendency to lay on fat rapidly.

Blood tells in hogs as well as in horses, and to save a sow for a breeder simply because she is not fat enough to kill when the others in the same lot are ready for market is one of the surest ways to secure inferior pigs.

It is usually better to buy a boar than to use one which has been raised on the place and is related to the sows which are to be bred, as the introduction of fresh blood will give larger litters and more vigorous pigs than can be expected from any close inbreeding. This is one of the principal reasons why the first crosses between different breeds are usually so satisfactory, and the offspring of such crosses, when bred among themselves, are so unsatisfactory. The breeding sows can usually be selected from those in the drove, but a new boar should be purchased as often as the sows have passed their prime and are replaced by the offspring of the old boar. If hogs are grown for the market only, it is not necessary to pay a fancy price for a fancy animal which has every bristle of just the right color and pointing in exactly the right direction. The man who is raising hogs to be sold as pure-bred breeding animals can not be too careful to purchase only such as come nearest the ideal shape, color, and style typical of the breed he is using; but for the man who is raising pork and who does not expect to sell fancy breeding animals, slight variations in color, shape and position of ears, and length of tail are of little importance. What the pork raiser should require in his boar is good form and size without coarseness, good feeding capacity, and a strong constitution. A short neck and short legs usually indicate good fattening qualities, and so are important requisites; they are even more important in the boar than in the sow. The boar should be small-boned for his size, but it is all

important that his frame should have sufficient strength to carry him well on his feet.

Among the points to be avoided in choosing a boar are a long head, neck, and legs, as such a form indicates an animal which will require a large amount of feed to produce a pound of meat, and one which can not be finished off for market until he has reached considerable age. Walking partially on the dew claws shows weakness of frame, and indicates a poor grazer and an animal which will break down before he reaches a heavy weight. In a young boar the shoulders should not be broader than the hams. The back should not be swayed, nor too strongly arched, though a back which is moderately arched is much less objectionable than one which is swayed.

In breeding for pork the boar need not have all the finer markings of his breed. Color of hair on the hog makes no difference with the quality of the pork, but he should have a good form, and should be descended from animals having good forms. A poor specimen of a pure-blood animal is little better than a scrub, and should not be used simply because he has a long pedigree. Pedigree is good because it gives prepotency, but form and vigor are better because they give pork. Good shape is absolutely necessary in a good boar, and if he has a good pedigree also he is a much better animal.

Nearly all breeders of fancy stock have numerous boar pigs which are not quite up to the standard in some unimportant particulars and so can not be sold as strictly first-class animals. The defects may be nothing more than a slight variation in color, swirls in the bristles, or a missing tail; but with even such defects the animals would stand a poor chance in the show ring, and breeders are often glad to sell them for little more than their value for pork. Such animals are just as good as anywhere pork and not show is wanted, and will insure much better pigs than can be expected from an equally well-formed grade or an inferior pure-blood.

The man who is raising hogs to be sold for breeders can not be too careful to use only such as come nearest the ideal for the breed; hence, from his point of view, defect in color, swirls, or a missing tail would be a serious blemish to the animal. The breeder of breeding animals can well afford to pay a relatively high price for an animal which is free from these minor defects, as his sales will depend largely on the general appearance of his herd, while the hogs of the pork raiser are sold by the scales.

Boars should not be purchased until they are four or five months old, as they do not show their form fully before that time. They cost less at weaning time, but their purchase at that time is a lottery, as a promising pig often develops into an inferior and poorly shaped animal. It is not safe to delay the purchase until the boar is wanted for service, as others will be wanting him at the same time, and there may be delay in finding a desirable animal. The service is more sure and

the boar can be handled with much less trouble if he has been on the place for a few weeks before he is needed for use. He should have time to become accustomed to his new quarters before he goes to service.

The boar should never be allowed to run with the sows, as he will be a continual worry both to them and to his owner, and it is much better to keep him in a lot where he can neither see nor hear other hogs. He should be kept as quiet as possible, and his food should be such as will give him strength and vitality, but not too fattening. He will do better service when he has sufficient grazing to give him exercise and only sufficient grain food to keep him in good condition without becoming so fat as to be heavy and unwieldy.

THE BREEDING SOW AND HER MANAGEMENT.

The sows for breeding can usually be selected from the drove. As "like produces like," they should always be selected from large litters from sows which are good milkers and good mothers. The gilts selected should be good feeders and have the prospect of becoming good milkers. A sow which is not a good feeder will produce only small litters, will be a poor milker, and her pigs will never make the quick and even growth necessary for good profits. It is impossible to judge accurately of the milking qualities in a gilt, but usually a chunky, easily fattened, heavy-bodied, and short-legged sow is not as good a milker as is the less attractive-looking one with a longer body, longer legs, and somewhat less rounded sides. Form should not be wholly sacrificed to the production of large litters and abundant milk, but good milking capacity is essential to a good sow. If the pigs are not able to get all the milk they need during the first six weeks of their lives, they become stunted in a way from which they never fully recover, and many pigs which die before they learn to eat solid food die of starvation. A sow which is a good milker is usually a prolific and careful mother also.

Many defects of form in the breeding sow may, to a great extent, be corrected in her offspring by mating her with a boar which is unusually strong where she is weak. If the sow is too long-headed, long-necked, and long-bodied, she should be mated with a boar having the opposite characteristics; if the sow has weak legs and her dew claws touch the ground the boar should have unusually strong and straight legs; if the sow is sway-backed the boar should have his back well arched. On the other hand, a boar which has weak points can often be used with success on a sow which is unusually strong where the boar is defective, though a weakness in the boar is not counterbalanced as readily as one in the sow, on account of his greater prepotency. A boar and sow having the same defects should never be mated, as similar defects are almost certain to be greatly exaggerated in the pigs.

It should be remembered that the boar gives half the blood to the whole herd, while the sow can influence only her own litter. For this

reason it is highly important that, whatever the sows may be, the boar should be one which will give vigorous pigs of good form. As nearly all the breeding sows in the drove at any one time will be the offspring of a single boar, and so will have a strong resemblance to each other, it will not be difficult to select a new boar which will be a fairly good mate for all.

Age at which to breed.—No uniform rule exists in regard to the age at which a sow should be bred the first time, as more depends on the maturity of the animal than on the number of months it has lived. In the South it is usually more profitable to raise two litters yearly, having them come about April and October. Where this is practiced, sows raised on the place must be bred when they are either 8 or 14 months of age, and the younger age is usually the better. A pig which has been properly cared for will weigh over 200 pounds at that age, and is sufficiently matured to produce a fair number of vigorous pigs. If not bred until 14 months old she may have one or two more pigs in her first litter, but even that is uncertain, and during her six months of waiting she will have earned nothing. A sow which has her second litter at 18 months will usually have more pigs than one which farrows then for the first time, and during the previous six months will have raised a number of pigs, which will be worth much more than the cost of her keep.

Young sows and old.—The number of litters which a sow should be allowed to have before she is fattened for butchering depends on the animal herself. When a young sow has only four or five pigs, or shows herself to be a poor milker or a careless and indifferent mother, the sooner she is fattened the better; but if she does fairly well she should be given a second trial. The second litter is usually larger than the first. If she then proves a good mother and her pigs from both litters develop into good porkers, she should be kept as a breeder until she can be replaced by a more prolific and better animal. An old sow which regularly raises large litters of good pigs is worth half a dozen untried gilts. An aged sow mated with a young boar will produce pigs which will mature earlier than those produced when the sow is young and the boar aged, which is a strong argument in favor of keeping a sow as long as she continues to breed satisfactorily. Ordinarily sows cease to be profitable breeders after they are 4 or 5 years old, but some raise good litters after they reach 8 or 9 years. When a sow more than 4 years old fails to give a good litter whenever it is due, she may as well be fattened at once.

One litter or two.—Whether it will be better to have one litter or two each year is a matter which each hog raiser must decide according to his own conveniences. When comfortable shelter is provided and good winter pasture can be secured, October pigs are usually as profitable as those which are farrowed in the spring. By the time they are ready to wean, oats and vetch should be in good condition for grazing,

and the young pigs will soon begin to eat artichokes so they need not be confined to dry feed. By spring they will be large enough to kill for a local market, or they can be kept growing through the summer with very little expense. By December they should weigh at least 300 pounds each, and be ready for market. In every town there are butchers who are always watching for opportunities to buy pigs weighing from 100 to 200 pounds for the local trade, and October pigs will often bring high prices for meeting that demand.

March or April pigs come at a season when they need little care, and can be carried through the summer at a very small cost. By December, if they have been well fed, they will weigh from 250 to 300 pounds each, and at eight months will be fully as profitable as the heavier October pigs, which have been kept fourteen months.

When only one litter is raised yearly, it should come as early as March, and often February is the better month.

CARE OF BREEDING SOWS AND PIGS.

During the four months the sow is carrying her pigs she needs good care, as she not only requires support for herself, but must have such an abundance of nourishing food as will enable her to produce healthy and well-developed pigs. During the first two months no change need be made in her usual food, and she can be left with the rest of the drove without danger, but as her time for farrowing approaches she should have somewhat different treatment. She should be kept in a separate lot from the fattening animals, as she will need different feed, though several pregnant sows can be kept in a lot together without danger. From this time onward her food should be such as will produce bone and muscle rather than fat, but she should never be allowed to become thin in flesh. Bran, shorts, shipstuff, ground oats, and peas should constitute the principal part of the grain feed, and but little corn should be used. Fresh green feed is especially needed at this time, and if grazing is not convenient green feed should be cut and fed liberally.

A week or ten days before farrowing she should be put in a pen by herself, so that she will have time to become accustomed to her new quarters before the pigs appear. The farrowing pen need not be large, 10 feet square is ample, but it should be where she will not be disturbed by other animals. The pen should have a floor, and running around the sides a 12-inch plank should be fastened 6 or 8 inches above the floor to afford the pigs a safe place where the sow can not crush or smother them. It takes the pigs only a day or two to learn the value of this protection, and it will often save much more than its cost. Little or no bedding should be used. The feed at this time should be strengthening, but not heating, and if any indication of costiveness appear she should have a good feed of wheat bran. A constant supply of salt and ashes is especially needed at this time to

satisfy the craving for such food, which often makes sows eat their young. Eating her young pigs is an unnatural act on the part of the sow, and is almost invariably the fault of the feeder in not giving her the food needed to satisfy a natural appetite.

When the sow is about to farrow, from one hundred and twelve to one hundred and sixteen days from the date of service, she should be given only light feeding, but should have all the water she wants. If she has had proper feed and treatment she will rarely need assistance in farrowing, but the owner should be at hand, watch her closely, and be ready to give help if needed. If it is very cold, the pigs should be taken away as fast as they are born and put in a warm basket, but should be returned to the sow as soon as she is through. It is true that many sows which run in the woods and are never looked after before farrowing will make nests in fence corners or behind logs and come up with fine litters of thrifty pigs; but it is also true that a still larger number of those which run at large crush or smother many of their young and lose others from various accidents which might easily be prevented. If young pigs are worth breeding they are worth caring for, and when the farrowing is properly looked after the losses will be very small.

After farrowing the sow should be given nothing but water or a little thin slop during the first twenty-four hours, and should be fed only lightly for several days. After the end of the first week her food should be increased as rapidly as is safe, and should consist of shorts, oats, and similar foods which will stimulate a flow of milk. The feeding of the sow during the first month after farrowing is of more importance than at any other time, as the vigor of the pigs depends on the amount of milk they receive from their dam. If the supply is too small, they are stunted so that they can never make the most profitable feeders, while if the supply of milk is too large, the pigs are almost sure to become affected with scours and receive a setback from which they are slow in recovering. It needs close watching and good judgment to give the sow just the right amount of food to keep both her and her pigs in the best condition. The amount of grain should be increased with the growth of the pigs, and green feed should be given liberally. A good start is necessary to the most rapid growth of the pig, and as the young pig must make its entire growth on food received through the mother it is poor economy to save feed on the sow at the expense of the future of her entire litter. After the first week there is less danger that the sow will be fed too much than that she will not be fed enough. If she should be overfed and the pigs show any indication of scouring, she should have less feed and be given strong limewater to drink. If the pigs are old enough to drink, they should be given scalded milk in which a little wheat flour has been mixed, and an egg stirred in with the milk for each two pigs will be beneficial. If the pigs are too young to drink, they should be given four or five drops of paregoric.

RAISING THE PIGS.

The pigs will begin to eat when they are about three weeks old, and the more they can be induced to eat the more rapid will be their growth. A feeding place should be provided for them adjoining the pen in which the sow is kept, and so arranged that the pigs can go in and out at will without being disturbed by the sow. A few grains of soaked corn scattered over the floor will soon get the pigs in the habit of eating, and they should be encouraged to eat as much as possible. As dry corn will hurt the teeth and make the mouth sore, shorts or oats should be given in the place of soaked corn as soon as the pigs learn to eat fairly well. When the pigs begin to drink, they should be given all the skim milk they want if it can be had, and if it is not available they should have a thin slop made of water and shorts. Corn meal is too fattening and is poor feed for young pigs.

By the time the litter is three weeks old both the sow and pigs should have the run of a lot where they can get sunshine, exercise, and fresh grazing, though the pigs should still have the feeding place where the sow can not come and should be fed regularly with all they will eat of food which will give them bone and muscle but will not be too fattening. Shorts, ground oats, and pease are the best grain feeds, and skim milk is worth more to a pig during the months before and after weaning than at any other time. Corn and rice are of little value for making growth. Bran is so harsh that it often causes irritation of the bowels, and is not a safe feed for pigs under three months old. Good grazing will make the larger part of the growth, but the pigs need grain feed also to make them do their best.

With such grazing as will be afforded by oats, vetch, and artichokes during the winter, and by alfalfa, clover, melilotus, and other crops in the spring, together with skim milk and such grain feed as has been named, the pigs will be well able to feed themselves by the time they are eight weeks old, and neither they nor the sow will hardly know when they are weaned. Pigs which have never been encouraged to eat, and are largely dependent on their mother's milk for food, often receive a severe check when they are weaned suddenly, and every day in which a pig does not grow adds that much to the expense of raising him. By giving the pigs all the solid food they will eat while still sucking, they become accustomed to it gradually, and when the time comes to separate them from the sow at about the end of the eighth week, they are so well prepared that they scarcely notice the change.

If the sow has been well fed while suckling the pigs she will have made a fair gain in weight during the last month, and after the pigs are weaned she should be given more fattening food to prepare her for raising another litter, or as the beginning of her fattening for market. When a sow has an abundance of good grazing, and not more than half her grain feed is corn, she will not become too fat for breeding. In fact a sow is rarely too fat for breeding, although there

is a common prejudice to the contrary. So long as she continues in good health and is making a fair growth her fatness will not make her less prolific, and she will usually produce larger litters and stronger pigs than when thin. This is especially true of young sows, and with such feed as has been recommended no sow will become too fat before weaning her second litter. The sow will usually come in heat in from one to two weeks after her pigs are weaned, and, if she is to be bred again, should be served at the first opportunity.

The pigs should be pushed as rapidly as possible after weaning, for the sooner they can be made to weigh 200 pounds each the more profitable they will be. Good pastures and good water are necessary for health and making a satisfactory growth, but in addition to these the pigs should have a liberal supply of bone and muscle-making food. Shorts, ground pease, peanuts, and other feeds rich in protein, together with skim milk when possible, are the best feeds for growth, and an exclusive corn diet is the poorest. Pigs will fatten rapidly when fed on corn alone, but the fattening will be at the expense of health and growth, and there will be many deaths from apoplexy before the pigs are six months old.

CASTRATING AND SPAYING.

Young boars not wanted for breeding should be castrated as early as is convenient. This may be done at any time after the pigs are a month old, and if done at from four to six weeks they will have fully recovered before they are weaned. If not done then, it is better to wait until a month after weaning, so that they will have become thoroughly accustomed to eating solid food.

Spaying young sows is no more difficult or dangerous than castrating young boars, and should be more generally practiced. It can be done best when they are between 3 and 4 months of age, and, as the young sows are liable to get with pig at any time after they are 4 months old, the spaying should not be delayed too long. By the time the pigs weigh from 75 to 100 pounds each they will be developed sufficiently to show which should be kept for breeding animals, and the sooner the others are spayed the better. Spayed animals are always more quiet and better feeders than open sows, make better pork, and sell for better prices. A spayed sow weighing 200 pounds will dress from 10 to 20 pounds heavier than an open sow of the same live weight; she will have heavier leaf and inside lard, and there will be no danger of loss from finding her in pig. Packers and butchers will always pay top prices for spayed sows, because such animals are sure to be as good as they look, while they will often refuse to purchase open sows at any price, or will take them only with a heavy allowance for shrinkage.

FOODS AND FEEDING.

The economical and profitable production of pork requires that the feed should be palatable, nutritious, and inexpensive. No one kind

of feed can be used exclusively with profit for feeding pigs, breeding animals, and fattening hogs, and no one feed will continue to be as palatable as a variety of feeds. It should be the object of every hog raiser to induce his animals to eat as much as possible, and the greater the variety the greater will be the amount of feed consumed. The cheapest and most profitable feed is that which can be grown with little labor and harvested by the hogs themselves, though it is economy to supplement each grazing crop with grain and other feeds suited to the condition of the animals.

PERMANENT PASTURE.

Hog raising can seldom be made profitable without a good permanent pasture, where the hogs can secure a large part of their coarser food at a nominal cost, and where they can have the exercise which is absolutely necessary to good health. If the hogs have an extended range, as in woods and canebrakes, they will make fully half their growth without further cost, and when such a range is not available pasture should be provided. There is no other grazing plant which will give so much hog food per acre through a large part of the year as alfalfa, and on soils where it can be grown it will pay well to provide the hogs with such a pasture. The soil for alfalfa should be sandy rather than heavy clay, and the subsoil must be well drained or the plants will be short lived. Good alfalfa soils are found in all parts of the South along the rivers and larger streams, on the marl hills, in the rotten limestone regions, and in the sandy hill lands of the middle district. The man who has land suitable for an alfalfa pasture need have no trouble in making pork profitably. Where alfalfa can not be grown Bermuda grass, lespedeza, and melilotus are excellent substitutes. The hog is naturally an animal which feeds over a wide range, and, although the food which he gets from the native pastures, or even from alfalfa, will not alone enable him to make the rapid increase desirable, still it is essential to health and will form a good part of the bone and muscle needed for satisfactory growth. A good pasture is as necessary for profitable hog raising as for the growing of beef animals, and no one should attempt to grow pork for market without providing at least one field where the hogs can have abundant exercise, and can find enough roots and herbage to keep them in health.

ANNUAL FORAGE CROPS.

While a permanent pasture is essential, temporary grazing crops will do much toward reducing the cost of making pork. There are a number of easily grown crops which furnish not only coarse forage, but also a large part of the grain feed which will be needed, and a selection can be made which will give a succession lasting nearly or quite through the year in a region where the ground is so rarely frozen.

Oats and vetch, sorghum, corn, sweet potatoes, cowpeas, peanuts, and artichokes all make excellent feed, can be grown with little expense, and in nearly all localities will make fields which can be grazed with profit from January to December. Other crops, like crimson clover, chufas, and cassava, have been found very profitable in some localities, while the gleanings of the corn and other fields always gives a good amount of inexpensive meat. It is always well to grow a variety of these grazing crops rather than to have a larger acreage of only one or two, as the greater variety not only gives a better succession of growths, each of which is grazed when in its prime, but gives better results in meat produced per acre.

Hogs are wasteful grazers when turned into rank pasturage, and a great saving of feed can be secured by growing the different grazing crops in long, narrow fields, which can be divided into sections by movable transverse fences. Usually there will be no trouble in arranging the fields so that this may be done, while, by maintaining a succession of plantings, and by fencing the hogs away from such recently grazed crops as oats, sorghum, and others which will make a second growth, the fields need not be large. By frequent changes of the feeding ground, 1 acre will yield abundant grazing for at least ten full grown hogs, or for a correspondingly larger number of younger animals and pigs.

Artichokes.—For winter and early spring there is no better crop than artichokes, which give a rich, fresh feed just at the time when grasses and clovers are at their poorest. There are few crops which can be more easily grown on any fairly good soil which will give a greater amount of green feed per acre and be more valuable for both growing and fattening animals. They should be planted in drills like Irish potatoes, the seed being cut in the same manner, and about the same amount being used per acre. Two cultivations will usually be sufficient to keep the ground mellow and free from weeds until the plants are so tall as to shade the ground, after which no further working is needed. The tubers do not form until late in the season, and in this latitude are rarely matured before the 1st of December. Even then they are not relished as well as they are later, and as they keep well in the ground until late in the spring, it is usually better to save them for January and February grazing, after the sweet potatoes, peanuts, and other crops are gone. Although the artichokes will make a volunteer growth from the scattering tubers left in the ground, such a crop can not be cultivated, and will be so choked by weeds and dwarfed by the hard ground that the yield will be small. It pays well to plow and replant the crop each season, even though it is planted on the same ground. Many object to artichokes for fear they will become a troublesome weed, but there is no danger from that source. If the young plants are plowed, or even hoed off well, in midsummer, after the old tubers are exhausted and before the new ones are formed, they will be

killed. The yield is variable—from 400 to 800 bushels per acre—and its feeding value is fully equal to that of other root crops. In some recent tests at the Oregon Station hogs which were given the run of an artichoke field, and were also given a partial feed of grain, made a gain of 1 pound in weight for each 3.1 pounds of grain fed, while it usually takes about 5 pounds of grain to make 1 pound of gain. In tests made at the Missouri Agricultural College 1 bushel of artichokes and 3 bushels of corn were found superior to 4 bushels of corn, and other tests have given similar results. The inexpensive gain in weight is not the only advantage in using artichokes, as the better health consequent on adding to the ration this fresh and succulent feed is a matter of great importance, especially in animals which are kept for breeding. The best soil for the crop is similar to that which is best for Irish potatoes. It should be rich, mellow, and well drained. On dry, hard clay the yield is always small.

Oats and vetch.—A mixture of turf oats and hairy vetch, sown in October or November, makes an excellent grazing crop for use after the artichokes are gone. When sown on fairly good corn ground, this crop will have made such a rank growth by February that it will furnish good grazing during the next two or three months. The turf oats bear grazing better than does rye or barley, are less easily injured by freezing, and will continue their fresh growth much later in the spring. It is undoubtedly the best grain crop we have for grazing. The vetch also makes a vigorous growth, and, pound for pound, gives a feed richer in protein or muscle-forming material than any other common pasture plant.¹ Its unusually large proportion of protein makes it specially valuable for young and growing animals, and it gives the very best of early grazing for fall pigs which are to be kept through the summer. When the oats begin to head and the vetch to flower, in April, stock should be taken off, so as to allow the plant to mature seed, which they will do late in May or early in June. The ground should then be plowed and planted in cowpeas or some other summer crop which can be cut for hay or grazed off in September and October, after which the vetch seed left in the ground, and usually the oats also, will make a volunteer growth fully as good as that of the previous season. The writer has used this rotation six years without replanting the vetch and there has been an almost constant increase in the yield. In some seasons the volunteer oats have failed to make a full stand, but the vetch has never failed to make a satisfactory growth. One bushel of the oats and 1 peck of vetch seed are sufficient to seed an acre. The soil should be a rich loam which is not too light. The vetch has not often been satisfactory on sandy soils, but recent experiments at the Alabama Station² show that by proper inoculation such soils will produce abundant yields. By the time the hogs are removed from the

¹ Experiment Station Record, Vol. VI, p. 98.

² Bulletin No. 56, Alabama Experiment Station.

oats and vetch the permanent pastures will be in fine condition and will give good grazing for many weeks. This will be especially true where alfalfa, melilotus, and clovers are grown, and at this time but little grain need be fed. During the early summer months growth of bone and muscle are more important than the accumulation of fat, and, although it pays to feed a little grain at all times, the amount used during the early summer may safely be less than at any other season.

Sorghum and Kafir corn.—Sorghum and Kafir corn are the best crops for early summer grazing, and by a succession of plantings will continue to furnish feed until late in the season or until killed by frost. The two crops are very similar and require the same treatment, sorghum being of the quicker growth and making the better summer food, while Kafir corn will make the better growth in the dry weather of early fall, and its heavier yield of seed, which matures just as the fattening period begins, makes it very valuable. The sorghum should be sowed broadcast at the rate of 1 bushel per acre as soon as there is no further danger from frosts, and it will make fair grazing in four or five weeks. As it is killed by too close grazing or by rooting, the field should be grazed in sections. If the field is arranged for temporary cross fences, as suggested on a previous page, it is better to keep the hogs on each section only a week and then give the plants three weeks to recuperate and make a new growth. When treated in that way, a small field may be grazed down two or three times, and a single planting will furnish feed at least two months, while later plantings treated in the same manner will still further prolong the season. Kafir corn may be planted at the same time as sorghum, but, as its greatest value is for grazing in late summer and early fall and for its seed, it is usually planted much later, and should be planted in drills, so it can be cultivated. The stalks are less sweet and so less valuable than those of sorghum, but it makes a greater weight of leaves per acre, and its yield of seed is fully one-half greater than that of sorghum. Being such a drought-resistant plant and producing such a heavy yield of seed (from 30 to 50 bushels per acre), it is often grown mainly for its seed, while its forage value is regarded as a secondary matter. In one test at the Kansas Experiment Station 100 bushels of Kafir corn seed was found to equal 83.7 bushels of corn for fattening hogs; in another test at the same station 100 bushels of Kafir corn seed equaled 84.8 bushels of corn; while in a third trial, with pigs soon after weaning, 100 bushels of the seed equaled 90.4 bushels of corn. At that station the average yields per acre for nine years had been 45.9 bushels of Kafir corn seed and 34.2 bushels of corn; or if expressed in pork, the yields had been 454 pounds of pork per acre from Kafir corn and 402 pounds from corn. In many places in the South the difference would be still more marked in favor of Kafir corn, as it will grow and yield much better than corn

on thin clay hills, which are specially subject to injury from drought. Where the Southern hog raiser has rich, moist bottom lands on which to grow corn and forage, Kafir corn has no marked advantage over sorghum, corn, and other crops.

Cowpeas.—Cowpeas give rich grazing from July until October, and should always be grown for use during late summer and early fall. Being very rich in protein, they make an excellent food for growing animals, though not desirable as the exclusive feed in the final fattening, as the fat meat produced by them is too soft and oily to be of the highest value. Lots for early use may be sown on the ground from which artichokes were harvested, and will be ready for use in two months from planting. For later use some of the quick-growing sorts may be planted on the vetch ground, or, if the ranker-growing and later-maturing sorts are sown on the artichoke ground or elsewhere, they will make an immense growth of forage for use in September and October. Usually, however, it is better to sow the pease for late grazing in the cornfield than to use land for that purpose alone. With the earlier-ripening varieties of pease and sorghum the hogs will be carried up to the beginning of cool weather without trouble.

Sweet potatoes.—For September, October, and November the best three crops are sweet potatoes, peanuts, and chufas, and as the soil becomes more sandy they become of more importance. All grow well in soils which are quite light and sandy, while none of them is worth planting on heavy soils. Sweet potatoes make the best root crop which can be grown for fall use in the greater part of the South, being less expensive to cultivate, yielding more heavily, and being richer feed than beets, turnips, or rutabagas. In some sections of Florida and along the Gulf coast, cassava is often a better crop, but with that exception the sweet potato is unexcelled for all soils which are not too wet and heavy. They can be planted at any time from May to July, and will be in condition for grazing from the 1st of August until late in November, or during the months when ordinary pastures are dry and such succulent food is worth more than at any other time. In grazing, the hogs will waste and destroy a large portion of the crop if allowed free range, and the field should be divided so that only a small part of it will be added to the feed lot at any one time.

Peanuts.—Peanuts are very rich in protein, and so are especially valuable for animals which are growing. Their yield in bushels is less than that of sweet potatoes, but their feeding value per bushel is much greater; and, as they are rich in muscle-forming materials while sweet potatoes have their chief value as fat producers, the two supplement each other. The best variety for grazing is the Spanish, which yields fully as well as others, and its compact growth makes it easier to cultivate. On soils of medium fertility and with ordinary care a yield of from 50 to 75 bushels per acre may reasonably be

expected, and as the hogs do the harvesting the expense of making the crop is much less than for securing an equal amount of food from most other crops. Some recent work at the Alabama Experiment Station shows¹ the high feeding value of peanuts in a very striking manner. Six pigs, with a total weight of 184.3 pounds, were used in the test, which lasted six weeks. The peanuts were grown on about one-sixth of an acre, and during the test 373 pounds, or a little more than $6\frac{1}{2}$ bushels of corn, were fed. At the close of the feeding the pigs had more than doubled in weight, having made a gain of 196.4 pounds. Valuing the corn at 40 cents per bushel and the pork at 3 cents per pound, the peanuts, when harvested by the hogs, were worth \$18.34 per acre. The expense of cultivating the peanuts was much less than for cultivating an equal area in cotton, and the thin, sandy soil on which the nuts were grown would not have made more than 200 pounds of lint per acre, while the yield of peanuts was 62.6 bushels per acre. In another test at the same station, peanuts alone, peanuts and corn meal, and corn meal alone were fed to determine their relative pork-producing value. At the close of the sixth week it was found that 2.8 pounds of peanuts alone, or 3.7 pounds of equal weights of peanuts and corn meal, had been consumed for each pound of gain, while 10.7 pounds of corn meal alone had been needed to make the same growth. On butchering the hogs used in the tests it was found that the peanuts had greatly softened the pork and lowered the melting point of the lard, and that this was not wholly corrected even when the hogs were fed on corn exclusively for a month before slaughtering. Like other feeds rich in protein, peanuts are more valuable for growing animals than for those intended for immediate killing. The bulletin says further: "It is highly desirable to arrange a succession of peanut crops rather than to have large areas ripen at the same time, for in wet weather Spanish peanuts will not remain long in the ground after maturity without sprouting."

Chufas.—Chufas grow well only on soils which are somewhat sandy, and will make good yields on soils which are too light for any other root crops, and so are specially valuable for soils where the yield of other crops is too small for profit. Like artichokes, they can remain in the ground uninjured through the winter, and so may be used for grazing at any time from November to February. From the fact that the tops of the plants, which are small and grass-like, do not cover the ground sufficiently to prevent the growth of weeds, the crop needs a longer time of cultivation than do sweet potatoes or peanuts, but the yield is large, often from 100 to 150 bushels per acre, and its season for use is so long that the small additional labor required in cultivation is not out of proportion to the value of the crop. At the Louisiana Station² they "were a splendid success, suggesting and

¹ Bulletin No. 93, Alabama Experiment Station.

² Bulletin No. 27, Louisiana Experiment Station.

proving themselves to be a splendid crop for hogs." At the Alabama Station¹ the yield was 172 bushels of green nuts per acre, the amount shrinking to 115.24 bushels when dried. The feeding tests which have been made with chufas show that while seldom profitable as an exclusive feed, they have great value as a fresh and succulent feed for use with corn and other grain.

Cassava.—Cassava is a plant which, from the limited tests it has received, promises to be an extremely valuable forage plant for Florida and for the immediate coast region westward to Texas. The valuable part of the plant is the thickened and starchy roots, which grow from 1 to 3 feet in length and from 2 to 3 inches in diameter. Each plant produces a cluster of these roots, and single clusters weighing from 15 to 20 pounds are not uncommon. Under ordinary field conditions the yield is from 5 to 8 tons per acre, though much heavier yields are often reported. The plants are propagated by cuttings of the stems and branches, which are buried and kept through the winter like sugar cane. Although the plant will survive a mild winter when left in the ground, annual plantings are more profitable. According to analyses made by the Department of Agriculture² the roots contain a much smaller proportion of water than is found in other roots used for feeding, and so are correspondingly richer in food elements which belong principally to the fat-forming group, 89.84 per cent of the dry material being carbonaceous while only 2.59 per cent is protein. Such a food is far more valuable for fattening than for growing animals, but it can be produced at such a low cost that some of the more expensive nitrogenous foods—shorts, peanuts, or cowpeas—can be used with it and so form a good growing ration at a low cost. When hogs have reached nearly their full growth, and it is desired to add fat for finishing off, it is claimed that cassava is the cheapest food known. In tests at the Florida Station³ the increase in weight in hogs fed seventy-five days cost only 1.04 cents per pound from cassava, while the cost of corn-fed meat was 3.06 cents per pound. In this estimate cassava is reckoned at \$6 per ton, the price paid for it at the starch factories, though the actual cost of growing it was less than \$2 per ton. Similar results have been secured at the Louisiana Station, and for the extreme southern section of the country, where the climate gives at least eight months free from frost, pork can doubtless be produced at less cost from cassava than from any other one plant.

Crimson clover.—Crimson clover makes good winter grazing along the South Atlantic coast and in some sections of Florida, but has not been generally satisfactory west of Georgia. Occasionally it makes a heavy growth as far west as Louisiana, but has usually been less valuable than the vetch, which matures at the same season. In sections

¹ Bulletin No. 16, Alabama Experiment Station.

² Bulletin No. 44, Division of Chemistry, U. S. D. A.

³ Bulletin No. 49, Florida Experiment Station.

where it grows its grazing value is about equal to that of the vetch; but very few localities have been found where both succeed, though one of the two can be made to grow on nearly all soils, and the one which succeeds best should be grown by every hog raiser for winter and early spring grazing.

Succession and rotation.—With such a large variety of plants, some of which will furnish grazing at all times, it is not difficult to make a selection for any locality which will give continuous pasturage through the entire year, and which will furnish fully one-half the food for the hog at an almost nominal cost. By arranging a proper rotation much of the ground can be made to produce two crops annually, and as all will be consumed in the field, succeeding crops can be grown without the use of fertilizers. The best succession of crops for different soils and localities must vary greatly, and the kinds grown on the hog lots will also be varied by those grown on the other parts of the farm. The size and shape of the lots will be varied by the location of the buildings, the ground available, and the location of the fields. While no one plan can be universally adopted, the following may be used on a great variety of soils and can be easily changed to suit the surroundings:

A field 20 rods in width and 40 rods in length is divided into five sections, each 4 rods in width and containing 1 acre. Shade should be provided by planting mulberry trees along the division fences. Beginning in April, lot No. 1 is planted with sorghum, to be followed by turf oats and vetch in October; No. 2 is planted in sweet potatoes, also to be followed by oats and vetch; No. 3 is planted in peanuts; No. 4 is planted in sweet potatoes in June or July for a late crop, and No. 5 is planted in artichokes. The following year lot No. 1, which was in oats and vetch through the winter, is planted in sweet potatoes, to be followed by oats and vetch in the fall; No. 2, also covered with oats and vetch through the winter, is planted in artichokes; No. 3 is planted in sorghum or Kafir corn, to be followed by oats and vetch in October; No. 4 is planted in peanuts, and No. 5 in sweet potatoes, both to be followed by oats and vetch.

In the case of some of these crops, as the sorghum and sweet potatoes, it is often better to plant the end nearer the buildings a few weeks before the farther end is planted, so that the entire crop will not mature at the same time. When the lots are planted in this manner, and temporary cross fences are used, so that the hogs have only a few rods of fresh grazing each week, such a 5 acre field will furnish good and constant grazing for from 25 to 50 hogs, together with the pigs which would naturally belong with such a drove. Of course the succession and varieties named may be changed almost indefinitely, and for many localities should be changed. In some sections crimson clover should be substituted for vetch, and on the light, sandy soils in the extreme southern section cassava should take the

place of artichokes. Chufas will sometimes be better than artichokes, and, when the hogs are to have fall grazing in a cornfield which has been planted with cowpeas, the peanuts may be omitted and some other crop increased. In arranging any such rotation the important point is to select crops which will give an uninterrupted succession, and the most abundant grazing at times when but little is to be had from other parts of the farm. It should be remembered that the meat which the hogs make by grazing is the least expensive, and it is poor economy not to make as much of it as is possible.

GRAIN AND OTHER FEEDS.

A certain amount of grain feed is needed to grow hogs with the greatest profit, and still more is needed to fatten and fit them for market, but it should be used only to supplement the feeds which the hogs harvest for themselves in the field. Pork can not be made economically when all, or even a larger portion, of the feed comes from the crib or the mill. The hog is an omnivorous animal and needs "roughage" and fresh green feed for his best health and growth and to produce meat of the best quality. When young his grain feed should be such as will furnish material for bone and muscle, and not such as will produce an excess of fat; while, as the animal approaches maturity, fat-producing foods should be given more liberally. No one kind of grain feed can be used economically from weaning until the full-grown animal is slaughtered, and there should be a gradual change from the nitrogenous, muscle-making food given to the pig to the carbonaceous, fat-making food, which is more profitable for the last few weeks before killing. The young animal must have good bone and muscle before it can carry the heavy load of fat desirable for the butcher or develop the strength, vigor, and health necessary in a good breeding animal.

Corn.—Corn has always been the staple grain food for hogs and is the best and cheapest for "finishing off" to make the animals ready for butchering. It makes the meat very firm, gives it a fine flavor, and makes a better lard than can be obtained from any other food. It is strictly a fattening food, however, and is not the best grain for young animals or for breeding stock. When young animals have an abundant range with a good supply of nitrogenous foods like alfalfa, clover, vetches, and cowpeas, corn makes a valuable addition to the ration, but should not be given in excess, and will usually be found more profitable if mixed with shorts, bran, or some other feed containing a larger proportion of protein. For the last few weeks before slaughtering, corn alone is often the most economical grain food. Little advantage will be secured by grinding it before feeding. Numerous tests have been made by the experiment stations and by other feeders in comparing whole corn with corn meal, and although the results have usually been in favor of the meal by from 4 to 8 per cent,

that difference will barely pay the cost of grinding. Corn meal or soaked corn can sometimes be used to advantage in feeding young pigs, but under ordinary circumstances it is fully as profitable to feed the corn dry and whole.

Shorts and bran.—Shorts and bran are among the best feeds for growing animals, and when they can be had for \$20 or less per ton will always be more profitable than corn for young stock. For young pigs bran is not so good as shorts, as it often has an irritating effect on the bowels, and when fed too liberally causes scours and other troubles from which the animal is slow in recovering. Shorts, when fed in reasonable amounts, seldom causes such troubles and is usually the best and cheapest grain feed for use during the first three or four months. As the animal grows older bran may be used more freely.

Cowpeas may be used in the place of shorts or bran, but as they require grinding their economical use is confined to the feeding of young animals, and the crop can commonly be used more profitably in other ways.

Rice bran and rice polish are cheap grain foods in the rice districts, but their feeding value is not equal to that of corn meal. They consist almost wholly of starch, and so are better for fattening than for growing stock.

Cotton seed.—Cotton seed has been used in almost every form for feeding hogs, but never with success when the feeding has been continued any length of time. It has been fed raw, roasted, steamed and boiled; and the meal, both raw and cooked, has also been tried in various ways, but almost always with the same result—the death of from one-fourth to one-half the drove within twelve weeks from the time the feeding began. Apparently the hogs do well the first few weeks after the feeding begins, but at about the sixth week occasional deaths occur, and the losses continue from that time onward. The hogs show no indication of sickness and make very satisfactory gains until within two or three days or sometimes within a few hours of death, and no curative treatment seems to have any effect. Nearly every experiment station in the Southern States has endeavored to find some combination of feeds, of which cotton seed should be a part, which could be fed with safety, but without success, and it seems useless to make any further attempt to use it as a hog feed. Before it had any commercial value, cotton seed was often thrown into shallow ponds where it soon became half rotted, and, when in that condition, hogs often ate it with impunity, but with the present market value of the seed more than double the amount of food can be secured by exchanging it for corn or shorts.

Skim milk.—Skim milk should always be used when it is available. It is not only a good flesh producer in itself, but it also makes the ordinary grain feeds more digestible, and so adds greatly to their value. While skim milk alone is rarely profitable, from 20 to 40 pounds being

required to make a pound of meat, when mixed with grain in the proportion of 3 pounds or less of milk to each pound of grain its value is greatly increased. In a test reported by C. P. Goodrich¹ 1 bushel of corn produced 10 pounds of pork, and 100 pounds of skim milk produced 5 pounds of pork, when fed separately. When fed together, however, the mixture produced 18 pounds of meat, an increase of 3 pounds due to the mixing. In this case 100 pounds of skim milk took the place of 44.8 pounds of corn. If the corn was worth 25 cents per bushel, the milk was worth 19.6 cents per 100 pounds; if the corn was worth 40 cents, the milk was worth 31.4 cents. Extended tests in the feeding of skim milk have been made at the Utah Station,² and among the facts brought out by the work are these: "The hogs fed on the milk-and-grain ration made much more rapid gains than either those fed on milk alone or on grain alone. The time required to make 100 pounds of gain was seventy-nine days for the hogs fed on milk and grain, one hundred and sixteen days for those fed on grain alone, and one hundred and forty-seven days when the feed was milk alone. The milk-and-grain-fed lots required 2.58 pounds of digestible matter, the milk-fed lots 2.85 pounds, and the grain-fed lots 3.19 pounds, to make 1 pound of gain in live weight." In this case 100 pounds of skim milk took the place of 23.2 pounds of grain in the mixture. Work at other stations has given very similar results, and has demonstrated that when not more than 4 pounds of skim milk is used with each pound of grain the milk is worth from 15 to 30 cents per 100 pounds. The younger and smaller the hogs the higher is the value of the milk. For full-grown and aged animals it is of less value. It may be taken as a safe rule that it is profitable to pay at least 15 cents per 100 pounds for all the skim milk needed to make four times the weight of the grain fed, and where it is impossible to secure enough for all the hogs the available supply should be given to those pigs nearest the weaning age and to sows suckling pigs.

Salt and ashes.—One item of feed which should never be neglected is a good supply of salt and ashes to which the hogs can have access at all times. Wood ashes can always be had, and the hogs should have all they will eat. When not convenient to give ashes, charcoal is a good substitute, and even soft coal will be eaten for want of something better. Hogs are never injured by eating all the ashes they want, but it is not safe to give large amounts of salt to animals not accustomed to its use. The salt and ashes mixture should be kept in a low box under a shed where it will be protected from rain, and should consist of about two quarts of salt for each bushel of ashes. Many feeders prefer to add a few ounces of copperas to the mixture. Free access to such a mixture will do much to preserve the health of hogs, and sows which have had an abundance of such food will rarely eat their young.

¹ Pork Production, p. 91.² Bulletin 57, Utah Experiment Station.

Cooking the feed.—Cooking feed is rarely profitable. It has been tested repeatedly in all parts of the country and with all kinds of feed, often with contradictory results, but those who have tested it most extensively and who have watched its results most carefully are almost unanimous in the opinion that cooking not only fails to increase the meat-producing value of the feed, but often actually causes a distinct loss. Irish potatoes are greatly improved by cooking, but as they are seldom fed to hogs in the South the purchase of a cooking outfit is usually a needless expense for the southern hog raiser. Soaking grain in water and allowing it to ferment before feeding is also seldom profitable, though soaking corn or wheat for very young pigs enables them to begin eating a little sooner. When ground feed—shorts, meal, etc.—is used with skim milk many feeders think it better to make them into a slop and let it stand until it begins to ferment, but the mixture should never be kept until it becomes soured.

HOW AND WHAT TO FEED.

Whatever feeds may be used the variety should be as great as possible, and changes should be made at every opportunity. The only object in raising hogs is the production of meat, and the more rapidly a hog can be made to produce meat the more profitable he becomes. The man who makes hog raising the most profitable is the one who induces his hogs to eat the most of the right kinds of food, and who never keeps them on any one kind of grain or forage until their appetites become cloyed and they get "off their feed." The greater the variety and the more frequent the changes the more will be eaten and the more rapid will be the growth.

No matter what food may be used or what the age of the animals which consume it, a great saving may be effected by feeding so that none of it will be wasted. While a hog is not over particular about cleanliness, and will eat food which is covered with almost any kind of filth, still he prefers clean food, and will not waste time and strength in rooting half an ear of corn out of the mud when he sees an ear which has not been soiled. Throwing corn or any other feed on the ground is wasteful, and if, as is too often the case, the hogs are kept in a small pen which is trampled and rooted so that it has become a permanent mud hole, the practice is exceedingly wasteful. In managing the grazing lots, especially those on which root crops are grown, the temporary cross fences, already referred to, will save from one-fourth to one-half the feed. It pays, and pays well, to have a floor on which to feed corn; and when shorts or other ground feeds are used they should always be wet and fed in a trough. The trough should have end pieces so long that the hogs can not turn it over, but should not be fastened to the floor, as it will need cleaning often. The feeding floor and trough should be under a shelter if possible. It is never a good plan to feed animals of different sizes in the same pen. When

large and small are fed together the small are sure to suffer, no matter how much may be given to the lot. The food which an animal gets by fighting may sustain life, but it will make very little fat. An ample variety of feeds suited to the age of the animals, and a feeding place where none of it will be wasted are the two important factors in profitable hog raising. In regard to feeding hogs, Hon. W. L. Foster, of Shreveport, La., who has been for many years one of the largest breeders in that State, says:

On the hill lands, rye, barley, oats, and artichokes are the best for winter grazing, taking the hogs off the grain crops about the last of February to permit the crops to mature seed. Sorghum, to come in shortly after barley or rye, ought to be planted in Spanish peanuts, sweet potatoes, and peas. Turn the hogs onto the oats when the seed is about ripe; then on the peas, sweet potatoes, and peanuts when sufficiently matured; then on artichokes again for the winter. Of course Bermuda pasture for summer grazing is a *sine qua non*. On alluvial lands I would say alfalfa for pasture the year around, with straight corn, hard (or better if soaked twenty-four hours). The alfalfa should be cut and fed when the ground is too wet to pasture. Hogs should run out at all times, but should have A-shaped shelters to go under when very cold or extremely hot.

For grain feed I think corn alone, and not much of it, good enough with alfalfa or clover. Skim milk with shorts, bran, oats, and corn meal in equal parts is, to my mind, the best feed, but hardly profitable for hogs intended for slaughter. I do not think it pays to cook feed, other than turnips, Irish potatoes, or similar crops, which are made more palatable. For growing pigs on alfalfa, soaked corn is good enough; while for pigs on Bermuda grass I think shorts, oats, and corn almost necessary to good results, unless one has plenty of peas, sorghum, and vegetables, or milk. For fattening I prefer the same feeds as for growing, except to increase the proportion of corn.

In writing of the same matter, Prof. J. F. Duggar, of the Alabama Experiment Station, says:

On sandy soils a suitable succession of crops for hogs is a mixture of hairy vetch and oats for spring grazing; permanent pastures, especially lespedeza, carpet grass, and Bermuda for June and part of July; sorghum or permanent pasture for July and a part of August; peanuts for August and September and October; sweet potatoes and the run of cowpea fields for November, and chufas for November, December, and January. The peanut diet, the cheapest of all the methods of growing pork yet tested here, should be discontinued at least two months before the hogs are killed. Corn should be the chief food in the few weeks immediately preceding slaughtering. Some corn must be fed to hogs on pasture, and can be fed profitably even when pigs are running in peanut fields. As soon as we have large enough areas of alfalfa we shall have a still cheaper method of growing pork. If pigs must be grown chiefly on grain, I prefer either a mixture of two parts corn and one part of cowpeas ground together, or shorts. Bran is too coarse. We have found sweet potatoes to be not more than one-fourth as valuable as an equal weight of corn, and yet, when harvested by the hogs, sweet potatoes constitute a valuable food on poor, sandy soil.

Director Redding of the Georgia Experiment Station uses nearly the same feeds. He says:

The best succession of grazing crops is vetches (*Vicia sativa* and *V. villosa*)

clovers (*Medicago maculata* and *M. denticulata*), red clover and orchard grass, crab grass, chufas, peanuts, sweet potatoes, and artichokes. For permanent pastures Bermuda grass is best for summer, while orchard grass, tall oat grass, red top and white clovers are best for winter and spring.

For feeds for the growing period I use shorts, bran, corn meal, and pasture; for the fattening period, peanuts, sweet potatoes, artichokes, and corn meal. Skim milk is undoubtedly good for growing pigs; bran and oats are unexcelled excepting by shorts.

FATTENING FOR MARKET.

The cost per pound of growing and fattening a hog for market increases with the size and age of the animal. It costs much less to raise two hogs weighing 300 pounds each than to grow one weighing 600 pounds, and even 500 pounds is too heavy to be profitable under ordinary circumstances. A hog must consume a certain amount of food to maintain his present weight, and for that food the owner receives no returns. Whatever the hog can be induced to eat in excess of the amount required for maintenance goes to the production of growth, and it is from this excess that all gains and profits are made.

These facts make it to the interest of the feeder to induce his hogs to eat all they can digest and to secure gains as rapidly as possible. A pig which is made to weigh 200 pounds at six months or 300 pounds at a year old is always profitable, while if it takes two years to make 300 pounds the last 100 pounds will usually be made at a loss. As the rate of growth, both in proportion to the size of the animal and to the amount of food given, decreases as the hog becomes larger, there must come a time when a pound of increase will cost more than it will bring on the market, and it is a nice point with the feeder to decide when that time will come and to market his hogs before it is reached. Ordinarily, this time will come when the hog weighs from 250 to 300 pounds, but may be reached either above or below those weights.

A hog 1 year old and weighing 300 pounds in November may still make a profitable gain if he has the gleanings of a recently harvested cornfield with an abundance of cowpeas, the leavings of a sweet potato field, or any similar food which would otherwise be wasted, but if none of these feeds are available, and all the food consumed must be purchased, it will be more profitable to sell at once, even if the weight is not more than 200 pounds.

As showing the increased cost per pound of gain with the increase in weight, Professor Henry, of the Wisconsin Station, has compiled¹ the results of more than 500 tests made at many different experiment stations. More than 2,200 hogs were used in these tests, and the work has been so extensive and carried on through so many years that the

¹ Henry: Feeds and Feeding, p. 551.

results may be regarded as very conclusive evidence. The figures are as follows:

Weight of pigs.	Average feed per day.	Feed eaten daily per 100 pounds of live weight.	Average gain per day.	Feed eaten for each 100 pounds of gain.
<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
15-50	0.223	5.95	0.76	293
50-100	3.35	4.32	.83	400
100-150	4.79	3.75	1.10	437
150-200	5.91	3.43	1.24	482
200-250	6.57	2.91	1.33	498
250-300	7.40	2.74	1.46	511
300-350	7.50	2.35	1.40	535

From these figures it is seen very plainly that the greatest as well as the most profitable gains are made on the lighter hogs, the last column showing a constant and almost regular increase in the amount of feed consumed for each 100 pounds of gain. Up to the time when the pigs weighed from 200 to 250 pounds each it required an average of 422 pounds of feed for each 100 pounds of gain, while for those exceeding 250 pounds in weight 523 pounds, or nearly 24 per cent more food was required to produce an equal gain. Pigs weighing less than 100 pounds each made the greatest gains for the food consumed, needing only 347 pounds of feed for each 100 pounds of gain, and, if feed were the only consideration, the 100-pound pig would be the most profitable; but there are other expenses which must be charged against him. The cost and care of the boar and sow are the same whether the pigs are butchered at 100 or 500 pounds. Losses are much more frequent among young pigs than among those which weigh more than 100 pounds each, and while there is a limited demand for "pig pork" at good prices, such pork can not be sold in unlimited quantities, as packers want only hogs which are fairly well matured. These expenses, risks, and market conditions all combine to make a somewhat heavier animal more profitable, even at some additional expense for feed. Although the figures given above represent the actual amounts of food consumed by pigs of different weights, they do not represent exactly the cost of the feed. The food of the younger pigs must consist largely of the more costly feeds, shorts, oats, pease, etc., while the older animals can be kept in good condition on coarser and cheaper foods, such as sweet potatoes, sorghum, or artichokes. When steers are being fattened on whole corn, hogs running in the same feed lot will secure a large proportion of their feed without expense from the droppings of the cattle. This will not be the case, however, when the steers are fattened on other feeds, corn meal giving very little feed for the hogs, and droppings from the steers fed on cotton-seed meal, the common fattening feed in the South, often prove positively injurious.

So long as a pig is making a fair gain on feed, of which he gets at least one-half by grazing, it is usually profitable to keep him, but after he reaches salable maturity, is in marketable condition, and draws a large proportion of his feed from the crib, he should be sold at once.

Usually it is better to have hogs ready for market as early as November or December, and it rarely pays to feed through the winter for making pork. Summer feeding is cheap, while winter feeding is expensive. Pigs farrowed in the spring should weigh from 200 to 250 pounds by fall, and if the market is not unusually depressed, it is better to let them go then rather than to feed through the cold weather and risk still lower prices in the spring. If good grazing is assured through the entire winter and grain is not too expensive, winter feeding is sometimes profitable on account of the higher prices which usually prevail in the spring, but ordinarily it is better to winter only the breeding animals and the fall pigs.

For the last few weeks of fattening, corn is undoubtedly the best grain feed, as it produces a meat which is of good flavor, prime, and wholesome. Hogs can be fattened cheaply on many other feeds, but the meat is greatly modified by the feed consumed during the last six or eight weeks, and animals which have been fattened on peanuts, cowpeas, mast, and similar foods should have corn as their finishing feed. Peanuts especially have a very softening effect on the lard, as is shown by Duggar,¹ who found the melting point of lard from corn-fed pigs to be 111.2° F., while that from peanut-fed pigs is only 76.1° F.

Feeding for the finish should not begin more than ten or twelve weeks before the hogs are to be sold. Hogs which have had good grazing through the summer and enough grain feed to keep them growing well take on flesh rapidly during the first few weeks of heavy feeding, but the longer the feeding is continued the slower and more expensive will be the gains. In testing this matter at the Wisconsin Station,² where pigs were fed twelve weeks, the average weekly gains during the first four weeks were 11.5 pounds each; during the second four weeks, 11.5 pounds, and during the third four weeks, 9.5 pounds. Although the actual gains during the second four weeks were equal to those of the first four, the increase was made at a much greater cost of food, the amount of feed required for each 100 pounds of growth during the first month being 418 pounds, during the second month 461 pounds, and during the third month 559 pounds, or one-third more than was required during the first month. Quick work pays in fattening as well as in growing hogs, and when the animals are on good feed and fail to make a gain of at least 1 pound daily they should be sold or butchered.

¹ Bulletin 93, Alabama Experiment Station.

² Report Wisconsin Experiment Station, 1897.

The man who is raising hogs in such numbers that he can ship them by the carload should time the farrowing and the final breeding so that he can fill a car with animals of nearly the same ages and weights, as such lots always bring much better prices than do mixed lots containing animals of different sizes and uneven in maturity. The man who raises only a small drove will usually find a demand for them in his local market, and where such a demand exists he will find it profitable to have a few animals in condition for butchering at any time except during the hot summer months.

DISEASES AND INSECTS.

The diseases affecting hogs in the South are very few, but are somewhat difficult to recognize, and still more difficult to treat successfully. Practically, the only contagious diseases which cause serious trouble are cholera and swine plague, which, though different diseases, resemble each other very closely and require the same treatment. Both are highly infectious and cause the loss of a large proportion of the animals attacked.

HOG CHOLERA AND SWINE PLAGUE.

Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, gives the symptoms of these diseases, as follows:

There are first seen the signs of fever, shivering, unwillingness to move, more or less loss of appetite, and elevation of temperature, which may reach 106° to 107° F.; the animals appear stupid and dull, and have a tendency to hide in the litter or bedding and remain covered by it. The bowels may be normal or constipated at the beginning of the attack, but later there is generally a liquid and fetid diarrhea, abundant, exhausting, and persisting to the end. The eyes are at first congested and watery, but soon the secretion thickens, becomes yellowish, accumulates in the angles, and gums the lids together. The breathing is more rapid than usual, and may be oppressed and labored in the later stages. There is a cough which, however, is not very frequent, and generally heard when the animals are driven from their beds. It may be a single dry cough, or it may be paroxysmal. The skin is often congested and red over the abdomen, inner surface of the limbs, under surface of the neck, and on the ears. The color varies from a pinkish red to dark red or purple. An eruption is sometimes seen, which leaves crusts or scabs of various sizes over the skin. There is a rapid loss of flesh, the animal grows weak, stands with arched back, and abdomen drawn up, and walks with a tottering, uncertain gait. There is less and less inclination or ability to move, and the weakness and exhaustion increases until death results.

The symptoms of swine plague in many cases are not noticeably different from those of hog cholera. Frequently, however, the lungs are—

extensively inflated in swine plague, and in that condition the breathing is more oppressed and labored, and the cough more frequent and painful.

The course of these diseases varies from one or two days to two or three weeks.

Although there is no known remedy which is invariably successful, Dr. Salmon recommends the use of the following:

	Pounds.
Wood charcoal	1
Sulphur	1
Sodium chloride	2
Sodium bicarbonate	2
Sodium hyposulphite	2
Sodium sulphate	1
Antimony sulphide (black antimony)	1

These ingredients should be completely pulverized and thoroughly mixed.

The dose of this mixture is a large tablespoonful for each 200 pounds weight of hogs to be treated, and it should be given only once a day.

He also says:

Hogs are fond of this mixture; it increases their appetite, and when they once taste of food with which it has been mixed they will eat it though nothing else would tempt them.

Animals that are very sick and that will not come to the feed should be drenched with the medicine shaken up with water. Great care should be exercised in drenching hogs or they will be suffocated. Do not turn the hog on its back to drench it, but pull the cheek away from the teeth so as to form a pouch into which the medicine may be slowly poured. It will flow from the cheek into the mouth, and when the hog finds out what it is it will stop squealing and swallow. A very easy method is to cut off the toe of an old shoe, insert the cut end into the hog's mouth, and pour the medicine into the shoe. In many of our experiments hogs which were so sick that they would eat nothing have commenced to eat very soon after getting a dose of the remedy, and have steadily improved until they appeared perfectly well. This is particularly the case when the disease is hog cholera.

This medicine may also be used as a preventive of these diseases, and for this purpose should be put in the feed of the whole herd. Care should, of course, be observed to see that each animal receives his proper share.

With these, as with all other diseases, prevention is much better than treatment. If cholera is known to be in the neighborhood the hogs should be confined in a small lot in which there is no stagnant water and where they will be protected from excessive heat or cold. They should be fed well, principally with bran, shorts, and other soft feeds, in which should be mixed a daily dose of the mixture described above. No one who has recently visited a place where the disease exists should be allowed to go near the lot. Care should be taken that the hogs have no access to any ground which receives drainage from an infected locality. Any animals which are purchased should be quarantined at least a month before being put with the drove.

Should the disease make its appearance in a drove, all the animals which appear to be still unaffected should at once be separated from the sick and placed in a pen as far away as possible. Should the disease appear among those which have been moved, the sound animals should be moved to still another place. It is of little use to move the sick, as the lot in which they have been kept is thoroughly infected. Different feeders should care for the sick and the well for fear of

carrying the contagion, as a bit of manure no larger than a pin head might easily be carried on the foot from the sick to the pen where the healthy animals are kept, and so spread the disease.

The carcasses of any animals which die from the disease should be burned immediately. Burying them is not safe, as the germs of the disease may retain their vitality for months when in damp soil, and if brought to the surface by dogs or worms, may cause another outbreak of the disease at any time. The lots where sick animals have been kept should be thoroughly disinfected by sprinkling heavily with lime, and should not be used again for at least six weeks. The disease is so fatal and so difficult to treat successfully that too much care can not be taken to prevent its introduction or spread.

THE HOG LOUSE.

The hog louse is the only insect which causes much trouble in raising hogs, and when it once becomes established in a drove it is not easily exterminated. Fortunately the lice are so large that they can be seen easily, and their presence may therefore be known before they become very abundant. They are liable to appear at any season of the year, and they thrive on hogs of any age or condition. They are found in and behind the ears, back of the shoulders, and in the creases on the lower part of the ham more frequently than elsewhere; if those places are free from them, there is little danger that they exist on other parts of the animal. Coal oil is sure death to every louse it touches, but does not always kill the eggs, and must be used with caution to prevent its blistering the skin of the hog. When a large drove is to be treated, the work can be done very quickly by using a spray pump having an attachment for mixing the oil and water, and the pump should be set so that it will use about five parts of water to one part of oil. When such a mixture is thrown over the hogs in a fine spray, only a little of the oil is used to cover the whole animal, and if the spraying is done in the evening, nearly all of the oil will have evaporated by morning, and there will be no blistering of the skin when the hogs are exposed to the hot sun on the following day. So little oil is used in the spraying that few of the eggs will be killed, and the work should be repeated at the end of a week, and again at the end of the second week. If the work is thoroughly done, three sprayings will be sufficient. If a spray pump is not available, the hogs should be rubbed with a mixture containing two parts of lard oil to one of coal oil, repeating twice at intervals of a week. The sleeping places should be thoroughly cleaned, the bedding burned, and the inside of the buildings thoroughly wet with coal oil.

Even with the most thorough treatment it requires time and patience to clean a drove which has become badly infested, but it must be done if the hogs are to be kept in a thriving condition. It is not difficult to destroy the larger part of the lice, but that is not sufficient, for

where there are even a few eggs left in the ears or under the jowls of a single animal the pest will soon become as bad as ever.

Lice never infest clean hogs when they are not brought from an infested drove, and the hog raiser who has a clean herd can not be too careful to keep it so. No stray hog should be allowed on the premises, and any which are purchased should be examined very carefully before they are allowed to run with the others. The oil mixture should always be kept close at hand, where it can be used immediately if any indications of lice are seen. It is much easier to kill a few lice on a few animals than to clean a thoroughly infested herd.

STATEMENTS OF SUCCESSFUL HOG RAISERS.

The following quotations give some of the actual practices followed by successful hog raisers and suggest some of the most serious obstacles likely to be encountered.

In speaking of raising hogs for pork, Mr. Foster, of Louisiana, to whom reference has already been made, says:

I think two litters should be raised where winter pasture can be had cheaply; otherwise only a spring litter to be turned off at eight or nine months. In feeding breeding sows I simply see that they are improving in flesh and strength and have laxative food before farrowing. If pasture does not keep their bowels in good condition, I feed bran or cotton-seed meal for a short time previous to farrowing. On our plantation I put up 32,000 pounds of green bacon last winter at a cost of a little less than 3 cents per pound on corn and alfalfa pasture, charging corn at 40 cents per bushel and pasture at \$5 per acre, but charging nothing for fencing, shelters, or labor, as the pasture (40 acres) furnished a great deal of feed for my colts, mules, and cows. The greatest obstacle to success, I think, is disease caused in a majority of cases by crowding too many hogs together and disregarding sanitation. I never keep more than three or four litters, having my pasture subdivided by portable fences into small lots of one-half to 1 acre each, with a cheap shelter in each lot. I never saw all of a large bunch of hogs do well when fed together. The fewer in a drove the better.

Professor Duggar, of Alabama:

Two litters a year are practicable and profitable.

The principal obstacles to success are:

- (a) The want of a market at steady prices. We need packing houses.
- (b) The attempt to make corn, which is high-priced in most Southern communities, the main or sole food for the hog. We need special hog crops, and pastures prepared especially for hogs.
- (c) Cho'era, which is largely preventable by proper fencing, feeding, and a knowledge of the means by which it is disseminated.
- (d) The cost of making hog-tight fences around fields where hog crops should be grown.
- (e) Scrub blood.
- (f) Financial loss due to keeping hogs past the age of twelve or fifteen months, and similar errors of judgment due to want of information.

Dr. Redding, of Georgia, says:

I prefer to have sows farrow in March, the pigs to be made into bacon the following December; farrow again in September, the pigs to be sold for butchers'

meat and consumed fresh. The March pigs in December should net 200 to 225 pounds each. The salted pork should be ready for "smoking" by February 1. The September pigs should be kept in good butchers' condition and sold as the market may demand.

Before farrowing, sows should be kept in good, thrifty condition, but certainly not fat, with moderate exercise required, or at least provided for. After farrowing, the best and most nutritious and milk-producing food should be given—mashed and scalded oats, shorts, bran, corn meal wet up with water, some green food, and pasture. Plenty of pure, clean water is desirable. The little pigs should be taught to drink skim milk, thin bran mashes, and the like as soon as possible. Later they should have a regular allowance of mashed oats, bran, and corn meal, with such green food as may be available. I consider the common collard an excellent soiling food for hogs. The collard leaves are especially suited for growing stock of all kinds, but particularly for hogs. The plants should be set out 1 foot apart, in 3-foot rows, in rich soil, in April. In a few weeks feeding may begin by pulling out every third plant and feeding them whole. Later, each alternate plant of those remaining may be removed and fed. After the patch has been thus thinned to one plant every 3 feet, commence to "prime;" that is, pluck off one or more of the bottom leaves of each plant, and so on all summer and fall.

Lucern is an excellent soiling plant, better and more convenient than red clover. The saccharine sorghums, and Indian corn (in roasting ear) fed "stalk and all," are both good.

It should not cost over \$5 or \$6 to produce a hog weighing 200 pounds.

I know of no insurmountable obstacle to profitable hog raising throughout the South. In fact, there is hardly an impediment in the way. Want of well-established pastures is noticeable.

CONCLUSIONS.

The obstacles mentioned can readily be overcome. Diseases caused by overcrowding can be avoided by building a few fences and cheap shelters. The exclusive or excessive use of corn is wholly unnecessary in view of the many other feeding crops available; and it is not economical by reason of the smaller cost of other feeds which are equally good or better for use, except during the short time of fattening. Scrub blood is as unprofitable in Kansas or Ohio as in Texas or Florida. Pure bloods can be obtained in one place as readily as in another, and with the use of well-bred stock every animal can be made ready for market without keeping it beyond twelve or fifteen months. Packing houses will be built as soon as the supply of hogs is in excess of the local demand, and until then the farmer will find it profitable to be his own packer. The man with a small herd will make a much better profit in proportion to his investment than the man who grows for shipment. With such a favorable climate and with food crops which can be produced at so little cost hog raising can be made profitable on every farm in the South.

THE MANUFACTURE AND EXPORTATION OF TASAJO, OR JERKED BEEF, BY RIVER PLATA COUNTRIES.

The manufacture and exportation of *tasajo*, or jerked beef, by the River Plata countries was of little interest to the people of the United States previous to our acquirement of Porto Rico and the establishment of close relations with Cuba. The fortunes of war having placed these islands under the care and protection of this country, our commercial men have quite naturally looked to them as new markets for our products; and the manufacturer of meat products has been no less interested than others. *Tasajo* is one of the principal articles of diet of these islands; it is, indeed, owing to its keeping qualities, their principal meat supply.

While the conditions which obtain in the River Plata countries will probably always prevent competition from the United States in the *tasajo* industry, even in Porto Rico and Cuba, an interest in the industry has been aroused and inquiries must be answered. Reports on the various phases of *tasajo* manufacture and exportation have been furnished the Department of State by Hon. François S. Jones, *chargé d'affaires ad interim*, Buenos Ayres, Hon. Albert W. Swalm, consul at Montevideo, and Hon. William I. Buchanan, minister to Argentina, and the facts of this article are a compilation of those reports.

HOW TASAJO IS MADE.

The method of making *tasajo* is simple, the chief agents in producing it being sun, salt, and air. The weight of the cattle killed for this purpose ranges from 750 to 950 pounds, and the age from 3 to 4 years. A carcass yields four pieces of *tasajo*—the fore quarters and the two sides, called *mantas*. These are cut into strips varying in thickness from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches, the principal being to cut the meat with the grain. These pieces are placed under shelter to cool for two or three hours and are then immersed in highly salted water from five to ten minutes. On the next day they are spread out and salted on the lean side, the salt being well rubbed in. On the third day the other side is salted in like manner. On the fourth day the salt is removed, and the pieces are piled layer upon layer. On the fifth day they are again dipped into a bath to remove all grains of salt, and are again piled layer upon layer in the open air to a height of from 10 to 12 feet in squares or parallelograms of from 15 by 25 feet in dimension. The whole of the process of making previous to the piling up is con-

ducted under shelter in buildings open on all sides. These piles are covered on the top with a canvass, held down with big stones to prevent the wind from removing it and gradually to weight down the meat in order to press out the remaining superfluous juices which trickle down the sides and form small pools around the bottom of the pile.

The time required for completing the process is dependent on the weather. The only operation necessary for the completion is to remove the pieces separately from the pile and hang them over wooden railings erected for the purpose. These pieces are removed every night and piled and others from the first pile are placed on the railings; thus the piles are reversed. Three or four such exposures to the sun and air are considered sufficient, in summer months, to obtain the Brazilian quality of tasajo. The Cuban quality of tasajo requires longer exposure and desiccation—about four or five exposures. In summer the meat is hung out on clear days from 9 a. m. to 5 p. m., and in the spring and autumn from 10 a. m. to 3 p. m. The greatest caution is taken to avoid its exposure during hours when dew is noticeable, as this spoils the meat.

The tasajo made for the Brazilian trade is the fatter kind, and the shrinkage is from 43 to 45 per cent, while the shrinkage for that made for the West Indies trade is from 50 to 52 per cent. The separation of these classes is made during the process of exposure. The price of the tasajo sent to Cuba is therefore from 10 to 15 per cent higher than that sent to Brazil. The price of tasajo ranges from \$6.50 in gold per 105 pounds, not including packing charges. Transportation charges should be added in estimating the cost in Cuba. The normal freight charges to Cuba range from \$8.76 to \$9.73 per ton.

KIND AND PRICES OF CATTLE USED.

The animals used for the production of tasajo are chiefly of the criollo, or native breed, though some mestizo, or mixed breeds, are also used. Steers and cows are used indiscriminately, though the product from the cows is alleged to be somewhat the better.

Apart from the influence which the supply of and demand for cattle must always necessarily have, the weight and quality of the animal naturally play an important part in determining the price of tasajo cattle. Consul Swalm reports the following prevailing prices by classes: Full-grown oxen, 5 to 6 years old, from \$13.75 to \$21, with an average of \$17; steers younger than the oxen class, from \$8 to \$22, with an average of \$17.50; cows of all ages, from \$8 to \$13, with an average of \$10.50.

The slaughtering season begins in October and ends in June. The numbers of cattle killed for tasajo in the provinces of Buenos Ayres and Entre Rios, Argentina, in the last four seasons were, according to Mr. F. S. Jones, as follows:

*Numbers of cattle killed for tasajo in Buenos Ayres and Entre Rios, Argentina,
1896-1899.*

Killing season.	Buenos Ayres.	Entre Rios.	Total.
	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>
1896.....	200,500	190,600	408,900
1897.....	240,900	170,500	420,400
1898.....	105,700	160,800	275,500
1899.....	100,600	150,200	250,800

The number of cattle killed for tasajo in Uruguay during the same period was as follows:

	<i>Number.</i>
1896.....	316,700
1897.....	303,400
1898.....	311,800
1899.....	306,400

The price of Uruguayan cattle is usually from 10 to 15 per cent higher than those of Argentina; this difference is due to the superiority of Uruguayan over Argentina cattle. Mr. Swalm states that the average price of cattle sold in Uruguay, all kinds of cattle considered, is \$15 per head. (Cattle are always sold by the head, not by weight.) The prices of cattle per 100 pounds in Kansas City for January, 1899, show how much more valuable are the cattle of the United States than those of the River Plata countries, and are as follows:

Heavy native steers.....	\$5.15 to \$6.65
Medium.....	4.50 5.15
Light steers.....	4.30 5.00
Cows.....	2.75 4.15
Canners.....	2.00 2.75
Western steers.....	3.75 4.95
Texans.....	3.60 4.65

Fat cattle are not much used in the making of tasajo, but cows, lean oxen, and steers are employed. Although these cattle do not represent the highest market value, they are in weight quite equal to the Kansas City standard, for the reason that most of them are Short-horn and Hereford crosses. Therefore the buyer of cattle for tasajo in Uruguay pays on an average of only about one-third for his animals that any competitor anywhere else pays for substantially the same animals. To state it otherwise, he starts in with an advantage in cost of fully 66 per cent in his favor, to say nothing about the climatic conditions which make more favorable the safe handling of the meat in all its stages, and which make losses next to impossible from taint or rot. These are conditions that should be considered well by any who may be thinking of competing in the Cuban markets with this class of meat products.

DOUBT OF SUCCESSFUL COMPETITION FROM UNITED STATES.

Mr. Buchanan expresses the hope that tasajo might be replaced in Cuba by our own beef cured in a similar manner, but says of tasajo itself: "I am free to say that the cheap live stock from which it is produced can be more advantageously bought in large numbers here [Argentina] than with us. Besides, I do not think it will be very easy to dislodge tasajo from any tropical market, since it is the only cheap form in which beef can be kept in that climate for a long period of time. It is therefore, I believe, a trade that will increase rather than decrease in Cuba and other tropical islands, and should have our careful study." Mr. F. S. Jones, writing along the same line, states: "The demand for tasajo must continue to prevail, for it will prove difficult indeed to discover a substitute for it in any tropical market, since it is the only cheap form in which beef can be kept at such points for a long time without deterioration. I hardly think that the United States can even at present compete advantageously with the tasajo industry of the River Plata, the lower price of cattle, the cheapness of labor, and the climatic advantages here being too great to be even offset by any mechanically improved methods of preparation which we might apply."

EXPORTS OF TASAJO FROM ARGENTINA.

The following table, copied from Mr. F. S. Jones's article already referred to, shows the quantity and value of exports of tasajo from Argentina for the years 1889 to 1898, inclusive:

Exports of tasajo from Argentina, 1889-1898.

Country.	1889.	1890.	1891.	1892.	1893.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Germany	48	54			35
West Indies (Cuba)	8,779	10,800	13,400	12,718	8,931
Belgium		201		3	
Bolivia				1	1
Brazil	21,797	22,000	19,982	22,530	12,152
Spain		3,300	507	1,706	5,076
United States	1				
France	105	151	254	121	188
Italy	193	1	40		
Paraguay	5	7			
Great Britain	604	2	59	690	217
Uruguay	2,530	3,308	3,069	4,049	4,242
Other countries	4,242	3,505	2,202	2,908	3,273
Total	38,304	43,479	49,633	44,696	41,116
Official valuation in gold	\$6,139,875	\$3,913,304	\$3,566,854	\$4,100,488	\$4,115,134
Export duty	None.	None.	<i>Per cent.</i> 4	<i>Per cent.</i> 4	<i>Per cent.</i> 4

Exports of tasajo from Argentina, 1889-1898—Continued.

Country.	1894.	1895.	1896.	1897.	1898.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Africa.....		1			
Germany.....		14		4,623	2,060
West Indies (Cuba).....	11,619	12,191	3,250		
Austria-Hungary.....		1			
Belgium.....	6	15	17	6	5
Bolivia.....	2	1	2		1
Brazil.....	22,271	31,429	32,273	24,970	14,369
Spain.....	1,118	2	36	29	1
United States.....		833	37	290	157
France.....	45	250	93	208	90
Italy.....		2	21	56	1
Paraguay.....	3		3		
Great Britain.....	46	212	12	232	
Uruguay.....	2,538	1,641	558	965	597
Other countries.....	5,190	8,497	9,605	4,849	4,961
Total.....	42,838	55,049	45,907	36,238	22,242
Official valuation in gold.....	\$1,761,447	\$1,225,419	\$3,217,541	\$2,446,315	\$2,116,458
Export duty.....	<i>Per cent.</i> 3	<i>Per cent.</i> 2	<i>Per cent.</i> 2	None.	None.

Quantity and value of tasajo exported to Cuba from Argentina.

Date.	Amount.	Value.	To port at—
	<i>Pounds.</i>	<i>Dollars.</i>	
1898.			
October 11.....	41,756	2,003.34	New York for Matanzas.
Do.....	41,765	2,031.56	New York for Cienfuegos.
November 7.....	19,823	1,062.80	Do.
Do.....	33,516	1,695.58	New York for Matanzas.
1899.			
January 18.....	125,804	7,371.33	New York for Cienfuegos.
Do.....	65,828	3,838.48	Do.
Do.....	57,390	3,436.01	New York for Matanzas.
Do.....	65,850	3,812.97	Do.
Do.....	63,341	3,808.22	New York for Habana.
Do.....	2,044	122.25	Do.
January 21.....	146,324	8,496.20	Do.
February 2.....	264,580	15,420.60	Do.
Do.....	128,122	7,460.10	New York for Cienfuegos.
Do.....	443,212	23,574.54	Habana.
February 7.....	243,873	12,989.76	Do.
February 8.....	490,125	25,863.30	Do.
Do.....	65,010	3,469.32	Cienfuegos via Liverpool.
February 17.....	837,900	43,382.54	Habana.
February 20.....	163,456	10,566.29	New York for Habana.
Do.....	128,692	7,255.95	New York for Cienfuegos.
February 22.....	61,486	3,155.67	New York for Matanzas.
Do.....	70,560	3,611.70	New York for Habana.
Do.....	419,931	23,409.37	Do.
Do.....	129,167	7,078.81	Do.

Quantity and value of tasajo exported to Cuba from Argentina—Continued.

Date.	Amount.	Value.	To port at—
1899.	<i>Pounds.</i>	<i>Dollars.</i>	
February 22	127,365	7,121.18	New York for Cienfuegos
Do.	62,585	3,495.48	Do.
February 23	23,997	3,569.93	New York for Habana.
Do.	128,908	7,247.97	Do.
Total.....	4,488,919	246,330.75	

The above tables do not specify the exports of tasajo to Porto Rico, but such exports are no doubt included in those for Cuba. Tasajo is largely used in Porto Rico, as the conditions there, as well as in Cuba, prevent to a great extent the use of meat in other forms. Mr. Frank H. Hitchcock, chief of the section of foreign markets of this Department, states that imports of tasajo into Porto Rico in 1894 amounted to 1,037,006 pounds, valued at \$63,578, and in 1895 to 2,272,249 pounds, valued at \$139,245.

TRADE OF PORTO RICO IN ANIMALS AND ANIMAL PRODUCTS.

Since Porto Rico was by treaty ceded to the United States, whatever enters into the trade relations of that island become matters of importance to the commercial interests of our country. While the meat producers of the United States will probably have no desire to establish themselves in stock raising on the island, they are on the watch always for new markets for the surplus of meat products of this country. However, Gen. Roy Stone, formerly director of the office of road inquiry of this Department, and later brigadier-general of volunteers in the Spanish-American war, in an article on "Agriculture in Porto Rico" in the Yearbook of this Department for 1898, states that the conditions obtaining there make cattle raising a very profitable industry. He says:

The industry is very profitable in the island, as various grasses and nourishing plants grow in profusion, and a good market for the surplus stock is found in Cuba and other islands. The cattle are of large size and of uniform light-red color, and they seem to fatten easily. The cows are nearly as large as the oxen, but do not yield milk in proportion to their size. On account of the heat the milk can only be kept by boiling, and cream and butter are unknown. A very coarse cheese is made, but otherwise there is very little use of the milk. Whenever it becomes possible to establish refrigerating plants a very good local dairy business can be inaugurated. These cooling plants could be operated by electric power derived from the abundant waterfalls in the island as soon as capital can be found for their exploitation.

Mr. Frank H. Hitchcock, chief of the section of foreign markets of this Department, has published a bulletin on the trade of Porto Rico (Bulletin No. 13, section of foreign markets), which deals in detail with the imports and exports of that island. The statistics relating to animals and animal products are quoted in this article.

Imports and exports of animals and animal products of Porto Rico, 1894 and 1895.

IMPORTS.

Articles imported.	Calendar years.			
	1894.		1895.	
	Quantities.	Values.	Quantities.	Values.
Animals, live:				
Asses.....number..	62	\$1,496		
Cattle.....do.....	38	1,232		
Horses.....do.....	9	1,448	1	\$241
Total.....		4,176		241

Imports and exports of animals and animal products of Porto Rico, 1894 and 1895—Continued.

IMPORTS—Continued.

Articles imported.	Calendar years.			
	1894.		1895.	
	Quantities.	Values.	Quantities.	Values.
Animal products:				
Bristles and hair.....pounds..	1,140	\$209	291	\$5
Dairy products—				
Butter.....pounds..	298,129	57,418	365,835	70,429
Cheese.....do.....	1,322,351	347,289	1,286,178	337,790
Total.....do.....	1,620,480	404,707	1,652,013	408,219
Feathers—				
For ornament.....pounds..	141	925	141	925
Other.....do.....	655	960	743	1,099
Total.....do.....	796	1,886	884	2,015
Glue and albumens.....pounds..	27,044	3,433	19,330	2,454
Grease.....do.....	14,061	616	37,908	1,600
Gut, dried.....do.....	1,448	9,510	732	4,896
Hides and skins.....do.....	6,781	593		
Meat products—				
Bacon, hams, pork, and lard.....pounds..	8,678,006	1,139,554	9,706,556	1,254,418
Jerked beef.....do.....	1,037,496	63,578	2,272,249	130,245
Meat, pickled.....do.....	33,426	2,194	90,769	5,960
Poultry and game.....do.....	251	33		
Other.....do.....	1,016,464	88,985	1,281,230	112,163
Total.....do.....	10,765,643	1,294,344	13,350,804	1,501,686
Wool, raw.....pounds.....	392	144	309	122
All other animal products.....		315		322
Total animal products.....		1,715,757		1,611,797
Total animal matter.....		1,719,933		1,632,038

EXPORTS.

Animals, live:				
Cattle.....number.....	4,306	\$166,212	3,674	\$141,816
Horses.....do.....	56	1,081	52	1,094
Sheep.....do.....	46	266		
Game-cocks.....do.....	54	194	188	363
Total.....		167,663		143,183
Animal products:				
Hides.....pounds.....	762,197	63,389	646,884	53,759
Honey.....do.....			2,679	567
Horns.....do.....	6,118	134	661	59
Meat scraps.....do.....			9,964	219
Tallow.....do.....	66,800	2,924	29,492	697
Total animal products.....		66,447		55,222
Total animal matter.....		234,110		198,705

In addition to the figures given in the table above, leather was imported into Porto Rico to the value of \$877,153 in 1894, and \$711,417 in 1895; woolens were imported to the value of \$262,648 in 1894, and \$154,947 in 1895.

The imports of hog products, comprising bacon, hams, pork, and lard, also come in chief part from the United States. Spain and the United Kingdom are the only other sources worth mentioning. The quantity and value imported from each country in 1894, 1895, and 1896, will be seen from the following table:

Quantity and value of hog products (bacon, hams, pork, and lard) imported into Porto Rico from the several foreign countries during the calendar years 1894, 1895, and 1896.

Countries from which imported.	Quantities.			Values.		
	1894.	1895.	1896.	1894.	1895.	1896.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>			
Spain	16,005	168,845	90,356	\$2,102	\$22,172	\$11,865
United States	8,658,504	9,458,807	10,230,477	1,136,993	1,242,684	1,342,104
United Kingdom	3,327	3,909	9,811	437	513	1,288
Germany		717	705		95	92
France	170	331		22	43	
Netherlands			697			92
British possessions		73,947			9,711	
Total	8,678,006	9,706,556	10,322,046	1,139,554	1,274,618	1,355,441

Value of exports to Spain from Porto Rico for calendar years 1892 to 1896, inclusive.

Articles exported.	1892.	1893.	1894.	1895.	1896.
Hides and skins	\$55,710	\$66,250	\$51,918	\$68,684	\$77,051
Grease	10,540	1,838	4,373	2,442	4,230
Leather			35	12,894	6,514

General Stone's statement that "cream and butter are unknown" in Porto Rico is evidently intended to apply to the people in general, who may not use it, for the statistics of imports show that butter was received in the island from Spain in 1892 to the value of \$14,098; in 1896 the value of butter imported from the same source was \$45,146. The United States also sends large quantities of butter there, as will be seen farther on.

The following table shows the value of imports of animal products into Porto Rico from Spain for the calendar years of 1892 to 1896, inclusive:

Value of imports into Porto Rico of animal products from Spain for the calendar years 1892 to 1896, inclusive.

Articles imported.	1892.	1893.	1894.	1895.	1896.
Butter	\$14,098	\$31,027	\$19,818	\$18,995	\$45,146
Meats and lard	8,382	7,247	12,508	10,216	22,485
Leather and leather manufactures	687,400	816,656	725,946	1,000,383	1,125,552
Woolens	42,388	67,042	83,339	61,369	89,174

EXPORTS FROM UNITED STATES TO PORTO RICO.

Commenting upon the statistics of exports of animal products to Porto Rico, Mr. Hitchcock says:

Among our meat products to Porto Rico hog products form the chief item. The average yearly export value for 1888-1892 was \$583,019, and for 1893-1897, \$636,633. Beef products were exported only in small quantities, the value of the annual shipments averaging but \$4,432 in 1888-1892, and \$4,318 in 1893-1897. The exportation of meat products, other than hog or beef, amounted to \$17,227 a year during the former period, and \$21,625 a year during the latter.

Statistics showing the annual value of each of these items, and of the total meat products exported from the United States to Porto Rico during the decade 1888-1897, are presented in the following table:

Value of meat products exported from the United States to Porto Rico during the fiscal years 1888 to 1897, inclusive.

Years ended June 30—	Beef products.	Hog products.	Other meat products (a)	Total meat products.
1888.....	\$1,962	\$483,522	\$8,723	\$494,207
1889.....	3,478	586,315	17,108	606,901
1890.....	5,619	523,916	26,022	555,557
1891.....	5,240	570,204	15,809	591,253
1892.....	5,843	751,137	18,475	775,455
Annual average, 1888-1892.....	4,432	583,019	17,227	604,678
1893.....	5,026	703,633	16,353	725,012
1894.....	4,839	821,990	27,905	854,734
1895.....	2,138	564,964	25,565	592,667
1896.....	2,180	599,513	18,830	620,523
1897.....	7,408	493,064	19,474	519,946
Annual average, 1893-1897.....	4,318	636,633	21,625	662,576

a Including oleomargarine.

Hog products.—Of the various hog products exported from this country to Porto Rico, lard and pickled pork are of leading importance. During the last five years the shipments of lard averaged 3,846,832 pounds a year, valued at \$273,209, and those of pickled pork 3,805,990 pounds a year, valued at \$252,247. Both of these items showed an increase during the decade, the average annual shipments for 1888-1892, as compared with the above figures for 1893-1897, amounting in the case of lard to 3,405,927 pounds, worth \$272,364, and in the case of pickled pork to 3,277,047 pounds, worth \$220,906. The exportation of hams, although of minor importance in comparison with that of lard and pork, increased quite rapidly during the decade, the average yearly shipment for 1893-1897 amounting to 83,313 pounds, valued at \$88,267, as against 283,093 pounds, valued at \$30,863, for 1888-1892. Accompanying this decided increase in the exportation of hams, there was a decline equally marked in that of bacon, the average shipment per annum in the latter product falling from 779,381 pounds, worth \$58,886, in 1888-1892 to 344,790 pounds, worth \$22,910, in 1893-1897. The exports of bacon during the latter period, however, were the largest in the last five years, amounting to 618,015 pounds, with a value of \$33,233.

The following statement shows the quantity and value of bacon, hams, pickled pork, and lard exported from the United States to Porto Rico during each year from 1888 to 1897, inclusive:

Quantity and value of hog products exported from the United States to Porto Rico during the fiscal years 1888 to 1897, inclusive.

Years ended June 30—	Bacon.		Hams.		Pickled pork.		Lard.	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
	Pounds.		Pounds.		Pounds.		Pounds.	
1888.....	453,785	\$39,206	231,842	\$27,594	2,302,136	\$185,200	2,923,878	\$231,522
1889.....	540,186	47,728	215,588	24,396	2,871,400	217,549	3,101,652	296,642
1890.....	917,615	64,646	126,644	14,543	2,812,900	173,739	3,531,225	270,988
1891.....	1,060,038	78,584	258,725	27,617	3,546,000	226,311	3,075,060	237,602
1892.....	919,281	64,266	582,662	60,164	4,762,800	301,731	4,397,820	324,976
Annual average, 1888-1892.....	779,381	58,886	283,002	30,863	3,277,047	220,966	3,405,927	272,364
1893.....	180,341	14,090	801,868	99,754	3,318,600	282,980	3,239,094	306,809
1894.....	230,970	19,038	799,812	98,695	4,480,400	360,684	3,979,784	343,573
1895.....	399,232	29,001	680,411	70,967	3,285,200	221,848	3,414,798	243,148
1896.....	295,306	19,186	985,718	92,549	4,495,550	243,311	4,027,501	244,467
1897.....	618,015	33,233	888,945	79,369	3,450,200	152,411	4,572,985	228,051
Annual average, 1893-1897.....	344,790	22,910	831,351	88,267	3,805,960	232,247	3,846,832	278,209

Beef products.—Under the head of beef products our leading export to Porto Rico is salted or pickled beef. The average annual shipments of beef in this form amounted to 72,146 pounds, valued at \$3,587, in 1888-1892, but in 1893-1897 they fell to 57,862 pounds, valued at \$2,869. The exportation of canned beef was very small, amounting to only 1,917 pounds, worth \$167, in the former period, and 3,281 pounds, worth \$268, in the latter. Other kinds of cured beef than those already mentioned do not appear to have been exported during the decade, except in 1897, when a single item of 86,000 pounds, valued at \$4,055, was recorded. Tallow was shipped to the extent of 9,955 pounds a year during 1888-1892 and 6,110 pounds a year during 1893-1897, the average annual value being \$678 for the former period and \$370 for the latter.

The quantity and value of the several kinds of beef named above, and also of tallow, exported from the United States to Porto Rico during each year of the decade 1888-1897 will be seen from the following statistics:

Quantity and value of beef products exported from the United States to Porto Rico during the fiscal years 1888 to 1897, inclusive.

Years ended June 30—	Canned beef.		Salted or pickled beef.		Other cured beef.		Tallow.	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
	Pounds.		Pounds.		Pounds.		Pounds.	
1888.....	1,176	\$114	35,150	\$1,711	.....	.....	2,400	\$157
1889.....	900	82	47,400	2,612	.....	.....	8,684	784
1890.....	900	88	91,600	4,534	.....	.....	14,704	997
1891.....	4,236	360	82,400	3,922	.....	.....	16,514	958
1892.....	2,252	190	104,180	5,157	.....	.....	7,472	496
Annual average, 1888-1892.....	1,917	167	72,146	3,587	.....	.....	9,955	678
1893.....	4,045	354	80,360	3,894	.....	.....	11,100	778
1894.....	6,166	509	79,300	4,159	.....	.....	3,305	171
1895.....	1,584	123	35,625	1,781	.....	.....	3,990	234
1896.....	2,112	163	32,925	1,606	.....	.....	7,591	411
1897.....	2,406	192	61,100	2,905	86,000	\$4,055	4,505	256
Annual average, 1893-1897.....	3,281	268	57,862	2,869	17,200	811	6,110	370

Oleomargarine.—The only other meat product of any considerable importance sent from this country to Porto Rico is oleomargarine, or imitation butter. The largest export of the decade occurred in 1895, amounting to 110,515 pounds, valued at \$13,540. In the following year, 1896, the quantity shipped fell to 18,440 pounds, worth \$1,738. In 1897 no shipments whatever were recorded. The average annual export for 1888-1892 was 48,568 pounds, with a value of \$5,541, and that for 1893-1897, 49,832 pounds, with a value of \$6,183.

Following is a statement showing the quantity and value of our exports of oleomargarine to Porto Rico during each year of the decade 1888-1897:

Quantity and value of oleomargarine exported from the United States to Porto Rico during the fiscal years 1888 to 1897, inclusive.

Years ended June 30—	Quantities.	Values.	Years ended June 30—	Quantities.	Values.
	<i>Pounds.</i>			<i>Pounds.</i>	
1888.....	12,600	\$1,627	1893.....	43,670	\$5,438
1889.....	82,429	8,800	1894.....	76,534	10,182
1890.....	68,010	8,092	1895.....	110,515	13,540
1891.....	59,100	6,648	1896.....	18,440	1,738
1892.....	20,700	2,448	1897.....		
Annual average, 1888-1892.....	48,568	5,541	Annual average, 1893-1897.....	49,832	6,183

Dairy products.—Our exports of dairy products to Porto Rico declined during the decade. The average annual shipments of butter fell from 116,129 pounds, worth \$15,321, in 1888-1892, to 72,141 pounds, worth \$10,090, in 1893-1897, and the average annual shipments of cheese for the same periods from 192,397 pounds, valued at \$23,539, to 90,526 pounds, valued at \$10,859. The exports of milk, although of little importance, increased considerably in the last few years, the average yearly valuation for 1893-1897 amounting to \$656, as compared with only \$177 for the preceding five years. The total value per annum of the three items, butter, cheese, and milk, which averaged as high as \$39,037 a year during 1888-1892, fell to \$21,605 a year during 1893-1897.

The following table shows the quantity and value of butter and cheese, the value of milk, and the total value of these three dairy products exported from the United States to Porto Rico during each year from 1888 to 1897, inclusive:

Quantity and value of dairy products exported from the United States to Porto Rico during the fiscal years 1888 to 1897, inclusive.

Years ended June 30—	Butter.		Cheese.		Milk.	Total.
	Quantities.	Values.	Quantities.	Values.	Values.	Values.
	<i>Pounds.</i>		<i>Pounds.</i>			
1888.....	191,038	\$26,514	133,498	\$16,957	\$55	\$43,526
1889.....	68,425	10,204	118,363	14,231	286	24,721
1890.....	108,557	13,711	186,624	22,448	163	36,322
1891.....	109,210	12,642	275,967	32,691	145	45,478
1892.....	103,417	13,533	247,532	31,368	239	45,140
Annual average, 1888-1892.....	116,129	15,321	192,397	23,539	177	39,037
1893.....	63,835	9,780	244,884	28,721	544	39,045
1894.....	139,774	21,456	130,545	16,568	605	38,629
1895.....	102,914	12,448	25,319	3,038	667	16,153
1896.....	20,655	2,754	25,404	2,946	737	5,437
1897.....	33,525	4,009	26,478	3,022	729	7,760
Annual average, 1893-1897.....	72,141	10,090	90,526	10,859	656	21,605

IMPORTS OF ANIMALS AND ANIMAL PRODUCTS INTO THE UNITED KINGDOM.

Under this head is brought together a number of tables showing the imports of animals and animal products into the United Kingdom for various years. The tables are all compiled from the published report of the board of agriculture of Great Britain for the year 1899. In another article in this volume, entitled "Imports and exports of animals and animal products," will be found the exports from the United States to the United Kingdom as given by the Treasury Department of our own Government. It will be noted by comparing these figures that there is a small difference, the reason for which is not apparent.

In the matter of the imports of cattle and sheep we have cause for gratification. No other country has furnished the United Kingdom so many cattle as our own during the last four years, and Argentina alone furnished more sheep during the same period.

Number of imports of cattle and sheep into United Kingdom by countries, 1896 to 1899, inclusive.

Country of export.	Cattle.				Sheep.			
	1896.	1897.	1898.	1899.	1896.	1897.	1898.	1899.
	Number.	Number.	Number.	Number.	Number.	Number.	Number.	Number.
Argentina	65,600	73,852	89,369	85,365	330,381	345,217	430,073	382,080
Chile					897		4,304	13,602
Denmark					63,263	12,797	28,086	22,650
Germany	2							
Norway	34				11,874			
United States	383,110	416,209	369,478	321,229	296,760	188,755	147,021	121,030
Uruguay	332	42		518	3,060	2,972		4,463
Queensland	32							
South Australia					518			
Aden						1		
Canada	101,501	130,495	108,405	94,660	83,767	63,761	42,070	63,930
Cape of Good Hope					1			
Channel Islands	1,710	1,633	1,814	1,732				
Falkland Islands							12,193	
British East Indies	25				11			
Lagos						1		
Total	502,553	618,321	509,090	503,504	769,532	611,504	683,747	607,755

The number of horses imported in 1898 was 42,921. Of this number 25,328 were from the United States. A statement is given herewith

showing the countries from which horses were imported and the number imported from each:

Algeria	6	Turkey	2
Argentina	227	United States	25,328
Belgium	202	Australasia	101
Denmark	2,545	Canada	6,359
Egypt	21	Channel Islands	23
France	316	Gibraltar	4
Germany	1,091	British East Indies	20
Holland	1,175	Malta	1
Norway	7	British South Africa	74
Russia	5,413		
Spain	3	Total	42,921
Sweden	3		

Number and value of imports of horses into the United Kingdom, 1885 to 1890, inclusive.

Year.	Number.	Value.	Year.	Number.	Value.
1885	13,023	\$952,004	1893	13,707	\$1,831,790
1886	11,026	919,773	1894	22,866	2,667,124
1887	11,641	961,705	1895	34,002	4,484,631
1888	11,505	937,405	1896	40,677	5,091,677
1889	13,832	1,349,909	1897	49,519	6,104,363
1890	19,286	1,634,687	1898	42,921	5,578,368
1891	21,672	2,103,632	1899	a 43,900	5,565,617
1892	20,994	2,070,214			

a The figures for 1899 are subject to revision.

The accompanying table shows that more than three-fifths of the meat importations are from the United States. Our largest competitors in the markets of the United Kingdom are Argentina, Holland, and New Zealand in the item of fresh mutton, Denmark and Canada in the item of bacon, and Queensland in the item of fresh beef. The total amount of beef, mutton, pork, bacon, hams, etc., imported was 1,806,660,464 pounds, of which 1,033,523,688 pounds was furnished by the United States.

Quantity of imports of meats, all kinds, into United Kingdom, by countries, in 1898.

[In hundredweights of 112 pounds.]

Countries from which exported.	Beef.			Mutton.	
	Fresh.	Salted.	Preserved.	Fresh.	Preserved.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Argentina	108,288	945	12,851	1,106,201	2,280
Belgium	2,860	143	8,201	747	
Brazil		60	224		
Colombia			3		
Denmark	36,663	37	5	4,316	
Egypt					
France		145	93	568	
Germany	1,119	202	1,615	1,279	

Quantity of imports of meats, all kinds, into United Kingdom, etc.—Continued.

Countries from which exported.	Beef.			Mutton.	
	Fresh.	Salted.	Preserved.	Fresh.	Preserved.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Greece.....					
Holland.....	1,533	3	394	265,543	
Italy.....					
Morocco.....					
Norway.....		122	29	442	8
Pacific Islands.....					
Portugal.....					
Russia.....			214		
Spain.....		159			
Sweden.....	2,443	20	11	6	
Turkey.....					
United States.....	2,301,956	203,045	136,323	625	788
Uruguay.....		1,880	7,458		
Australasia:					
New South Wales.....	48,459	1	37,179	478,537	66,433
Queensland.....	483,032	16	63,075	58,357	3,735
South Australia.....			574	10,470	
Victoria.....	160		383	72,125	4,223
New Zealand.....	92,756	30	3,313	1,314,619	39,060
Canada.....	21,543	1,537	9,365	171	1,777
Channel Islands.....	9		4		
Falkland Islands.....				4	
Gibraltar.....					
British East Indies.....					
Malta.....					
Total.....	3,106,821	208,945	281,344	3,314,001	118,814

Countries from which exported.	Pork.		Bacon.	Hams.	Meat, unenumerated.		Total.
	Fresh.	Salted.			Fresh or salted.	Preserved.	
	Cwts.	Cwts.			Cwts.	Cwts.	
Argentina.....	1,306			40	17,540	7,124	1,256,481
Belgium.....	35,102		1,586	420	4,798	5,688	59,545
Brazil.....							284
Colombia.....							3
Denmark.....	1,031	70,940	1,017,520	908	19,928	106	1,151,463
Egypt.....						5	5
France.....	10,621	296	76	423	9,877	3,229	25,328
Germany.....	8	11,168	814	1,125	2,418	3,707	23,455
Greece.....						2	2
Holland.....	222,672	617	17,481	169	249,939	1,226	759,577
Italy.....			3	12	100	28	163
Morocco.....					11		11
Norway.....		26	7		3	580	1,212
Pacific Islands.....						6	6
Portugal.....				22	2	7	31
Russia.....	3	8	10,072	16	99	1,194	11,006
Spain.....				204		22	285
Sweden.....		270	40,456		112	6	43,324
Turkey.....				8		10	18
United States.....	276,829	175,000	4,087,380	1,851,520	90,412	103,412	9,227,899
Uruguay.....						8,420	17,764

Quantity of imports of meats, all kinds, into United Kingdom, etc.—Continued.

Countries from which exported.	Pork.		Bacon.	Hams.	Meat unenumerated.		Total.
	Fresh.	Salted.			Fresh or salted.	Preserved.	
Australasia:	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>
New South Wales.....	3	.....	.....	.....	1,655	4,631	628,898
Queensland.....	30	.....	.....	.....	2,684	2,514	613,445
South Australia.....	.....	.....	.....	.....	30	5,361	16,335
Victoria.....	2	.....	.....	2	173	19,271	90,339
New Zealand.....	.....	.....	1	.....	8,682	3,374	1,461,865
Canada.....	10,075	17,659	535,879	117,428	6,504	5,381	127,349
Channel Islands.....	20	.....	6	.....	.....	.....	32
Falkland Islands.....	.....	.....	.....	.....	.....	.....	4
Gibraltar.....	.....	.....	.....	.....	.....	36	36
British East Indies.....	.....	.....	.....	.....	.....	1	1
Malta.....	.....	.....	32	2	10	32	76
Total.....	557,602	275,993	5,711,322	1,972,299	414,977	175,279	16,130,897

The butter imports amounted to 359,425,136 pounds. Denmark, which also has the lead in the bacon trade, furnished 163,883,360 pounds of this large quantity. The United States furnished 7,471,744 pounds. Besides Denmark, the countries of France, Holland, Russia, Sweden, Victoria and New Zealand in Australasia, and Canada each furnished a larger quantity of butter than the United States.

Canada furnished 160,404,272 pounds of the total amount of 262,018,624 pounds of cheese imported. The United States ranked second, with 54,431,440 pounds.

The imports of eggs by the United Kingdom were principally from Belgium, Denmark, France, Germany, and Russia. Our contribution to the trade was 23,293 thousands. The value of the total imports in 1898 was \$21,694,460.

Quantity and value of imports of butter, margarine, cheese, milk, and eggs into United Kingdom, by countries, 1898.

QUANTITY.

[In hundredweights of 112 pounds.]

Country of export.	Butter.	Margarine.	Cheese.	Margarine cheese.	Condensed milk.	Milk and cream.	Eggs.
	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Thousands.</i>
French West Africa.....	.....	.....	.....	.....	4	.....	.....
Argentina.....	14,729	.....	50	.....	.....	.....	.....
Belgium.....	30,384	3,260	48,752	.....	23,909	1	261,066
Brazil.....	.....	.....	.....	.....	5	.....	.....
Canary Islands.....	10	.....	41	.....	.....	.....	.....
Chile.....	.....	.....	.....	.....	.....	.....	27
Denmark.....	1,465,039	44	28	.....	784	1,289	242,541
Egypt.....	.....	.....	15	.....	.....	.....	17,735
France.....	416,821	30,290	33,086	.....	308,954	7,339	251,812
Germany.....	41,231	13,974	563	.....	6,798	4	28,536
Greece.....	.....	.....	5	.....	.....	.....	.....

Quantity and value of imports of butter, margarine, cheese, milk, and eggs into United Kingdom, by countries, 1898—Continued.

QUANTITY—Continued.

Country of export.	Butter.	Marga- rine.	Cheese.	Marga- rine cheese.	Con- densed milk.	Milk and cream.	Eggs.
	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Thousands.</i>
Holland	260,324	844,177	232,925	891	336,062	384	7,266
Italy	293		556	37	3,665	1	200
Japan			2				
Morocco							9,466
Norway	27,138	8,477	65		106,898	362	10
Persia		16					
Portugal					12		12,084
Russia	180,333		227		580		437,508
Spain	564		32		41		15,123
Sweden	204,962	26	31		34	1,204	794
Turkey	5		17				236
United States	66,712		485,995	9,237	28,820		23,293
Uruguay	200						
Spanish West Indies		18					
Australasia:							
New South Wales	34,391	204	4			1	
Queensland	6,989				370		
South Australia	1,602						
Victoria	124,223		165			114	
New Zealand	69,949		44,439			1	
Canada	156,845	20	1,432,181		31		89,443
Cape of Good Hope	141						
Channel Islands	251	10	45				661
Gibraltar			3				223
Hongkong					115		
British East Indies	983		23				
Malta	3		51		76		
Newfoundland	20		151				
British West Indies					80		
Total	3,209,153	900,615	2,339,452	10,165	817,274	10,691	1,730,962

VALUE.

Country of export.	Butter.	Marga- rine.	Cheese.	Marga- rine cheese.	Con- densed milk.	Milk and cream.	Eggs.
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
French West Africa					39		
Argentina	347,542		641				
Belgium	847,958	39,438	513,528		231,880	10	3,556,915
Brazil					58		
Canary Islands	195		584				
Chile							423
Denmark	35,816,618	506	209		3,343	11,110	3,335,728
Egypt			180				175,463
France	10,627,682	512,466	457,947		3,032,652	12,074	3,977,566
Germany	1,041,655	181,657	6,195		45,954	29	3,838,909
Greece			49				
Holland	6,469,710	10,754,305	3,527,901	7,611	2,434,394	3,110	99,415
Italy	7,847		6,653	618	19,812	5	1,768
Japan			19				

Quantity and value of imports of butter, margarine, cheese, milk, and eggs into United Kingdom, by countries, 1898—Continued.

VALUE—Continued.

Country of export.	Butter.	Margarine.	Cheese.	Margarine cheese.	Condensed milk.	Milk and cream.	Eggs.
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Morocco							117,636
Norway	630,842	110,951	764		933,035	3,689	185
Persia		204					
Portugal					92		141,997
Russia	4,285,566		1,007		1,932		4,701,667
Spain	10,565		472		647		165,948
Sweden	7,307,867	438	339		258	23,841	10,468
Turkey	92		302				2,540
United States	1,388,450		4,898,551	60,359	279,678		329,153
Uruguay	3,407						
Spanish West Indies		297					
Australasia:							
New South Wales	815,713	3,261	34			10	
Queensland	167,748				1,621		
South Australia	39,866						
Victoria	2,947,206		1,849			1,041	
New Zealand	1,640,823		441,752			29	
Canada	3,221,306	204	14,325,638		200		1,224,947
Cape of Good Hope	3,436						
Channel Islands	6,258	127	652				9,971
Gibraltar			34				2,738
Hongkong					934		
British East Indies	13,232		219				
Malta	63		467		973		
Newfoundland	482		1,603				
British West Indies					574		
Total	77,678,415	11,603,604	24,187,682	74,588	6,988,055	54,938	21,694,469

For purposes of comparison the quantity and value of the imports of butter are given for the years 1895 to 1899, inclusive:

Quantity and value of imports of butter into the United Kingdom, by countries, 1895 to 1899, inclusive.

QUANTITY.

[In hundredweights of 112 pounds.]

Country of export.	1895.	1896.	1897.	1898.	1899. ^a
	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>
Argentina	3,676	15,763	10,860	14,729	20,121
Austrian Territories			7		
Belgium	24,732	38,132	30,518	36,384	62,033
Brazil	118	20			
Canary Islands		3		10	
Denmark	1,162,770	1,228,784	1,334,726	1,465,090	1,430,052
Egypt	20				
France	454,843	467,602	448,128	416,821	353,942
Germany	112,338	107,825	51,761	41,231	36,953
Holland	191,201	234,469	278,631	269,324	284,810

^a The figures for 1899 are subject to revision.

*Quantity and value of imports of butter into the United Kingdom, by countries,
1895 to 1899, inclusive—Continued.*

QUANTITY—Continued.

Country of export.	1895.	1896.	1897.	1898.	1899. ^a
	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>
Italy	496	1,359	1,349	293	.....
Norway	15,156	17,075	28,212	27,138	30,965
Russia	128,550	151,805	198,060	180,333	138,938
Spain	58	27	.....	564	122
Sweden	310,800	323,829	299,214	294,962	245,599
Turkey	31	23	13	5	.....
United States	68,982	141,553	154,193	66,712	159,187
Uruguay .....	.....	.....	4	200	.....
Australasia:					
New South Wales	45,837	7,777	23,835	34,391	43,561
Queensland	151	.....	1,280	6,980	1,677
South Australia	1,351	1,133	163	1,602	7,187
Victoria	212,797	154,865	169,075	124,223	211,744
New Zealand	53,282	56,373	76,522	69,949	111,659
Aden .....	.....	4	14	.....	.....
Canada	38,949	89,357	109,402	156,865	250,083
Capo of Good Hope .....	.....	8	.....	141	306
Channel Islands	289	362	374	251	130
Gibraltar .....	.....	.....	.....	.....	19
British East Indies	558	570	828	983	686
Malta	58	.....	.....	3	21
Newfoundland	680	.....	.....	20	45
Total	2,825,662	3,037,718	3,217,802	3,200,153	3,380,851

VALUE.

	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Argentina	84,562	359,766	256,163	347,541	.....
Austrian Territories .....	.....	.....	190	.....	.....
Belgium	600,404	927,282	739,310	847,958	.....
Brazil	2,969	482	.....	.....	.....
Canary Islands .....	.....	54	.....	195	.....
Denmark	28,948,195	30,602,562	32,830,935	35,816,618	36,758,796
Egypt	462	.....	.....	.....	.....
France	11,892,432	12,349,693	11,341,748	10,627,682	9,289,409
Germany	2,750,025	2,609,641	1,280,362	1,041,654	907,057
Holland	4,571,230	5,629,217	6,586,073	6,469,710	6,898,350
Italy	12,585	35,067	33,598	7,747	.....
Norway	341,818	491,333	672,545	660,842	.....
Russia	3,063,892	3,674,597	4,721,790	4,285,566	.....
Spain	825	434	.....	10,565	.....
Sweden	8,001,066	8,101,190	7,376,178	7,307,867	6,064,323
Turkey	657	500	336	92	.....
United States	1,322,598	3,006,185	3,083,166	1,388,456	3,426,313
Uruguay .....	.....	.....	73	3,407	.....
Australasia:					
New South Wales	992,444	183,423	546,108	815,713	1,047,617
Queensland	2,477	.....	34,679	167,748	.....
South Australia	31,374	27,019	3,971	39,866	.....

^a The figures for 1899 are subject to revision.

Quantity and value of imports of butter into the United Kingdom, by countries, 1895 to 1899, inclusive—Continued.

VALUE—Continued.

Country of export.	1895.	1896.	1897.	1898.	1899.
Australasia—Continued.	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Victoria	4,782,222	3,745,730	3,973,005	2,947,206	5,116,434
New Zealand	1,138,805	1,352,391	1,785,791	1,646,824	2,644,226
Aden		49	204		
Canada	746,526	1,653,363	2,164,921	3,221,297	5,421,067
Cape of Good Hope		204		3,436	
Channel Islands	7,178	8,682	5,027	6,258	
Gibraltar					
British East Indies	6,229	6,492	10,492	13,232	
Malta	1,100			63	
Newfoundland	12,030			462	
Total	99,334,155	74,673,366	77,455,674	77,678,005	883,799,576

^a Including \$8,194,408, the value of butter imported from such of the above countries as to which the information is incomplete.

Herewith is given a table showing the quantity and value of imports of wool, by countries, for the years 1894 to 1898, inclusive. The total imports for 1898, although not so great as in 1897, amounted to the enormous sum of 694,299,733 pounds. New Zealand furnished 135,857,500 pounds, New South Wales 152,658,462 pounds, and Cape of Good Hope 69,635,158 pounds. The United States had a very small share in this trade, furnishing but 943,232 pounds. The United Kingdom does not consume all of this enormous quantity, as the statement below shows that about half of it is reexported:

Year.	Imports.	Reexported.
	<i>Pounds.</i>	<i>Pounds.</i>
1894	704,467,947	345,927,043
1895	775,379,063	404,935,226
1896	718,537,253	334,691,833
1897	740,748,903	371,532,812
1898	694,299,733	283,317,748

Quantity and value of imports of wool into the United Kingdom, by countries, 1894 to 1898, inclusive.

QUANTITY.

Country of export.	1894.	1895.	1896.	1897.	1898.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Argentina	7,955,835	11,251,620	7,239,648	12,338,050	17,580,717
Belgium	5,871,148	7,885,168	11,391,012	9,609,019	10,742,655
Chile	5,142,576	5,386,750	7,167,530	7,994,674	12,994,638
China	3,680,340	4,204,400	2,187,000	1,603,890	3,667,020
Denmark	2,002,606	2,637,297	1,120,832	1,822,208	1,232,619
Egypt	2,459,618	4,397,940	3,145,630	2,701,805	2,442,722

¹ Includes wool of lambs and the alpaca.

Quantity and value of imports of wool into the United Kingdom, by countries, 1894 to 1898, inclusive—Continued.

QUANTITY—Continued.

Country of export.	1894.	1895.	1896.	1897.	1898.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
France.....	16,695,979	26,263,836	20,280,339	23,345,473	20,318,764
Germany.....	1,831,118	3,544,188	3,312,738	6,199,400	3,150,022
Morocco.....	1,286,599	1,337,700	557,272	1,858,600	1,438,650
Persia.....	2,258,308	1,228,250	416,200	1,984,200	1,538,100
Peru.....	7,053,536	5,980,730	6,333,568	7,304,375	5,581,958
Portugal.....	1,959,905	2,021,020	2,363,900	3,032,270	1,402,150
Russia (northern ports).....	2,152,813	3,739,015	4,950,800	6,609,900	4,582,468
Russia (southern ports).....	5,234,447	7,603,890	5,058,460	5,141,610	6,585,570
Spain.....	209,790	1,248,464	851,332	2,415,704	754,695
Turkey.....	16,682,117	21,873,348	16,542,910	25,727,462	14,096,338
United States.....	480,774	475,634	4,513,110	687,601	943,232
Uruguay.....	1,272,319	1,421,740	1,963,329	3,244,730	2,631,216
Other foreign countries.....	2,553,045	2,763,096	2,246,188	3,902,673	3,306,777
Australasia:					
New South Wales.....	173,227,826	186,086,926	163,717,080	165,843,338	152,658,462
Queensland.....	49,209,000	55,543,200	50,044,200	62,195,616	46,572,700
South Australia.....	45,100,830	50,567,508	46,675,270	36,688,010	24,960,500
Victoria.....	95,539,914	111,193,444	82,370,220	84,456,615	74,662,503
Western Australia.....	8,798,346	8,650,000	11,550,190	9,486,272	8,539,680
Fiji Islands.....		4,000			
New Zealand.....	124,791,838	124,227,005	117,648,300	127,672,688	135,857,500
Tasmania.....	5,334,736	5,122,000	5,639,920	4,968,300	4,336,200
Cape of Good Hope.....	55,126,493	60,139,550	70,476,150	59,032,370	69,635,158
Falkland Islands.....	5,383,393	4,136,100	4,091,200	4,142,450	4,788,800
British East Indies:					
Bombay.....	37,311,708	35,447,048	40,056,340	35,172,330	34,525,584
Bengal.....	2,876,515	2,674,484	2,612,440	3,248,250	2,580,830
Other parts.....	968,589	871,710	684,580	928,410	1,333,350
Natal.....	15,459,100	15,194,530	21,228,250	19,006,310	18,028,010
Other British possessions.....	47,786	188,872	101,324	301,300	830,142
Total.....	705,467,947	775,379,063	718,537,253	740,748,963	694,299,733

VALUE.

	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Argentina.....	1,056,824	1,620,608	1,033,977	1,727,606	2,327,355
Belgium.....	1,456,981	2,034,372	2,779,798	1,997,369	1,808,441
Chile.....	623,428	728,038	1,080,558	1,075,837	1,747,497
China.....	461,830	527,733	278,719	185,647	252,493
Denmark.....	357,746	444,268	196,573	322,664	198,519
Egypt.....	383,038	760,361	516,049	448,375	371,533
France.....	3,362,277	5,053,554	3,967,771	4,484,494	4,289,129
Germany.....	340,193	187,424	600,220	988,951	587,713
Morocco.....	217,541	229,684	89,617	285,425	197,607
Persia.....	261,467	148,165	51,271	250,085	181,102
Peru.....	1,522,593	1,540,885	1,473,309	1,463,644	1,138,075
Portugal.....	410,270	447,129	464,532	587,567	297,829
Russia (northern ports).....	328,338	606,882	811,742	1,378,791	702,830
Russia (southern ports).....	828,280	1,171,508	878,004	953,639	1,232,920
Spain.....	30,080	140,330	97,714	260,538	81,176
Turkey.....	2,124,838	2,321,572	2,122,652	3,439,166	1,701,114

*Quantity and value of imports of wool into the United Kingdom, by countries,
1894 to 1898, inclusive—Continued*

VALUE—Continued.

Country of export.	1894.	1895.	1896.	1897.	1898.
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
United States	63,746	86,487	776,148	118,125	155,791
Uruguay	186,825	193,147	282,997	453,655	370,793
Other foreign countries	449,986	526,325	463,028	620,946	555,788
Australasia:					
New South Wales	29,484,357	29,531,625	27,949,429	27,196,012	26,308,356
Queensland	7,952,951	8,439,343	8,284,710	9,553,879	7,718,152
South Australia	6,898,371	7,164,194	7,076,806	5,160,802	3,339,299
Victoria	18,508,234	20,176,217	15,949,779	15,353,467	14,254,942
Western Australia	1,225,214	1,069,404	1,653,174	1,290,626	1,360,145
Fiji Islands		462			
New Zealand	22,776,125	21,389,552	22,298,897	22,253,895	21,043,880
Tasmania	944,922	819,207	1,048,545	881,489	867,060
Cape of Good Hope	10,822,867	11,789,145	11,155,053	9,310,841	11,184,166
Falkland Islands	652,948	506,690	657,605	651,512	786,782
British East Indies:					
Bombay	5,031,756	4,791,365	5,313,615	4,655,138	4,642,661
Bengal	345,935	301,081	312,935	385,738	326,307
Other parts	151,820	52,135	39,263	96,775	154,792
Natal	2,528,629	2,406,100	2,923,798	2,566,178	2,465,161
Other British possessions	5,689	16,521	12,424	33,019	84,572
Total	126,867,090	133,331,513	122,689,112	120,121,186	115,164,224

IMPORTS AND EXPORTS OF ANIMALS AND ANIMAL PRODUCTS.

By GEORGE FAYETTE THOMPSON,
Editorial Clerk, Bureau of Animal Industry.

The Bureau of Statistics of the Treasury Department reports that the value of all merchandise, domestic and foreign, which was exported from the United States during the calendar year of 1899 was \$1,275,499,-671. This was an increase over 1898 of about \$20,000,000. The value of animals and animal products, both domestic and foreign, which was exported during 1899 was \$259,829,062; excluding foreign exports, the value of exported animal products was \$256,285,487. This sum is \$18,333,360 greater than the like exports of 1898, and shows that the increase of \$20,000,000 in the total exports is almost entirely of animal origin. The accompanying statement of the value of the total exports of animals and animal products for the years 1892 to 1899 permits a comparison for the several years:

1892.....	\$224,531,279
1893.....	196,243,366
1894.....	215,462,956
1895.....	219,492,191
1896.....	217,048,412
1897.....	214,400,463
1898.....	237,952,127
1899.....	253,285,487

These figures not only include the principal animal products, such as animals and meat and dairy products, but boots and shoes; bones, hoofs, horns, horn tips, etc.; candles, eggs, feathers, and glue; grease, grease scraps, etc.; hair and hair manufactures; lard oil; and wool, both raw and manufactured.

Our imports of animals and animal products for 1899 amounted in value to \$96,572,932. This was an increase over 1898 of \$13,970,807 and a decrease from 1897 of \$8,354,067. The value of horses, cattle, and sheep imported in 1899 was \$4,122,364. The value of our imports of bristles was \$1,871,010, and was over a million dollars in 1898 and 1897. We paid \$4,719,756 for imported feathers in 1899, and \$2,477,332 for imported hair; \$1,068,273 for hide cuttings and glue stock; \$5,750,-

934 for leather, and \$6,143,384 more for leather manufactures. Of this latter sum \$5,544,871 went for gloves. Our imports of dairy products amounted in value to \$2,271,764, and sausage casings \$622,544. Hides and skins (other than furs) and wool, including the hair of the goat, camel, and alpaca, always form the large items of our imports of animal products. Hides and skins cost us in 1899 \$51,127,659. This was an increase over 1898 of \$11,221,286. A tabular statement on page 438 shows the imports and exports of hides and skins, by countries. Our imports of wool and wool manufactures in 1899 was valued at \$14,596,847, as against \$15,207,738 in 1898, being a decrease of \$610,891. The tabular statement on page 436 shows that these imports were subdivided as follows: Clothing wool, \$2,803,680; combing wool, \$1,499,276; carpet wool, \$7,356,688; carpets, \$2,272,415; cloth, \$4,584,394; dress goods, \$5,460,164. The total value of our exports of raw wool and wool manufactures amounted to the comparatively small sum of \$1,229,539.

Anyone interested in the articles comprising our exports of animals and animal products, and a comparison with other years, will find important data in the following table: *

Quantity and value of imports of animals and animal products for 1897-1899, inclusive.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Articles imported.	1897.		1898.		1899.	
Horses.....number.....	5,903	\$505,838	2,728	\$521,835	3,215	\$581,928
Cattle.....do.....	403,717	3,581,643	261,826	2,730,882	186,506	2,235,373
Sheep.....do.....	414,445	1,145,922	360,820	1,187,210	361,731	1,305,063
All other, including fowls.....		212,078		242,080		282,363
Bones, hoofs, horns, etc.....		252,864		784,360		988,302
Bristles.....pounds.....	1,535,620	1,308,932	1,650,357	1,245,591	2,280,448	1,871,010
Eggs.....dozen.....	190,672	9,259	129,811	6,531	259,106	24,628
Feathers.....		5,594,143		4,649,479		4,719,756
Hair.....		2,383,700		1,829,112		2,477,332
Hides and skins.....pounds.....	236,372,088	33,230,749	256,188,970	39,906,373	318,261,631	51,127,659
Hide cuttings and glue stock.....				290,500		1,038,273
Leather.....		6,373,726		5,236,171		5,750,934
Leather manufactures.....		6,789,576		6,110,644		6,163,384
Meat and meat extracts.....		628,798		175,580		330,949
All other meat products.....		50,358		110,031		114,693
Dairy products.....		2,232,382		1,807,065		2,271,764
Sausage casings.....		194,191		500,943		622,544
Wool and wool manufactures.....		40,431,831		15,207,738		14,596,847
Total.....		104,926,999		82,602,125		96,572,806

In the matter of cattle it is observed that the number exported 1899 was greater than for the year 1898 by 11,297 head; the value, however, was reduced by the sum of \$2,777,806. The table given her

with shows that only one year since 1896, namely, 1897, has given a larger number of exports of cattle, while the values of the three previous years have all been greater. Our imports of cattle in 1899 were 186,596 in number and \$2,235,383 in value.

A satisfactory increase in the exports of hogs was made, the number for 1899 being 52,230, valued at \$363,609. This is an increase over 1898 of 35,351 in number and of \$246,063 in value. In 1896 there were 18,445 fewer hogs exported than in 1899, but the value was \$4,308 greater.

The exports of horses show an increase in number and a decrease in value. There were 1,066 more horses sent abroad in 1899 than in 1898, but the total value was \$263,305 less. We imported during the year 3,215 horses, valued at \$581,928.

Exports of mules show a decided increase, from 6,996 in 1898 to 20,228 in 1899, the value being for the former year \$514,569 and for the latter \$1,702,099. This great increase is no doubt due to the purchases made of mules for use in the British army in South Africa. On this question Mr. Joseph L. Craden, in a recent issue of *The National Farmer and Stock Grower*, says: "The South African war between the British and the Boers commenced about the middle of October. Since that time, or up to the close of the year 1899, the English Government had purchased about 10,000 head of 14 to 14½ hand pack mules, principally on the market at the National Stock Yards."

Sheep have decreased in number and value. The decrease in 1899 from 1898 was 25,674 in number and \$209,629 in value. The table given herewith shows that we have for several years imported more sheep than we have exported.

Number and value of imports and exports of farm animals for the calendar years 1896 to 1899, inclusive.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Calendar year.	Cattle.		Hogs.		Horses.		Mules.		Sheep.	
	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.	Num-ber.	Value.
EXPORTS.		<i>Dolls.</i>		<i>Dolls.</i>		<i>Dolls.</i>		<i>Dolls.</i>		<i>Dolls.</i>
1896	394,772	36,576,412	33,785	367,917	28,632	3,601,137	6,534	475,106	323,576	1,948,841
1897	447,469	39,379,532	16,841	150,814	45,642	5,617,265	7,753	631,904	218,427	1,331,712
1898	397,879	33,463,267	16,879	117,546	48,917	6,010,773	6,996	514,569	176,498	1,070,966
1899	409,176	30,685,461	52,230	363,609	49,983	5,747,468	20,228	1,702,099	150,824	861,337
IMPORTS.										
1896	141,653	988,677	-----	-----	8,232	509,819	-----	-----	382,443	1,013,481
1897	403,717	3,581,643	-----	-----	5,993	505,838	-----	-----	414,435	1,145,922
1898	261,826	2,730,882	-----	-----	2,718	321,835	-----	-----	390,820	1,187,210
1899	186,596	2,235,383	-----	-----	3,215	581,928	-----	-----	361,731	1,305,063

Quantity and value of imports of butter, margarine, cheese, milk, and eggs into United Kingdom, by countries, 1898—Continued.

VALUE—Continued.

Country of export.	Butter.	Margarine.	Cheese.	Margarine cheese.	Condensed milk.	Milk and cream.	Eggs.
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Morocco							117,636
Norway	630,842	110,951	764		933,035	3,689	185
Persia		204					
Portugal					92		141,907
Russia	4,285,506		1,007		1,932		4,701,067
Spain	10,565		472		647		165,948
Sweden	7,307,867	438	389		258	23,841	10,468
Turkey	92		302				2,540
United States	1,388,456		4,898,551	66,359	279,678		326,153
Uruguay	3,407						
Spanish West Indies		297					
Australasia:							
New South Wales	815,713	3,261	34			10	
Queensland	167,748				1,621		
South Australia	39,866						
Victoria	2,947,206		1,849			1,041	
New Zealand	1,646,823		441,752			29	
Canada	3,221,306	204	14,325,638		200		1,224,947
Cape of Good Hope	3,430						
Channel Islands	6,258	127	652				9,971
Gibraltar			34				2,798
Hongkong					934		
British East Indies	13,232		219				
Malta	63		467		973		
Newfoundland	462		1,603				
British West Indies					574		
Total	77,678,415	11,603,604	24,187,682	74,588	6,988,055	54,938	21,694,460

For purposes of comparison the quantity and value of the imports of butter are given for the years 1895 to 1899, inclusive:

Quantity and value of imports of butter into the United Kingdom, by countries, 1895 to 1899, inclusive.

QUANTITY.

[In hundredweights of 112 pounds.]

Country of export.	1895.	1896.	1897.	1898.	1899. <i>a</i>
	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>	<i>Cwts.</i>
Argentina	3,676	15,763	10,860	14,729	20,121
Austrian Territories			7		
Belgium	24,732	38,132	30,518	36,384	62,053
Brazil	118	20			
Canary Islands		3		10	
Denmark	1,162,770	1,228,784	1,334,726	1,465,030	1,439,652
Egypt	20				
France	454,843	467,602	448,128	416,821	353,942
Germany	112,338	107,825	51,761	41,231	36,959
Holland	191,201	234,469	278,631	269,324	284,810

a The figures for 1899 are subject to revision.

doubled over the previous year, being 17,001,068 pounds, valued at \$2,869,580, against 6,847,850 pounds, valued at \$1,125,391, in 1898. This increase represents 10,153,218 pounds in amount, or \$1,744,189 in value. Notwithstanding this large increase the exports would no doubt have been much greater had not the domestic markets of the United States offered such prices for high-grade butter during the year as to preclude exports upon a commercial basis.

The value of our exports of butter to the United Kingdom from 1892 to 1899 is shown in the following statement:

1892	\$864,453
1893	440,856
1894	615,689
1895	1,202,111
1896	2,469,987
1897	2,906,621
1898	1,125,391
1899	2,869,580

Quantity and value of animals and animal products purchased by the United Kingdom from the United States in the calendar years 1898 and 1899.

Kind of goods.	1898.		1899.	
	Quantity.	Value.	Quantity.	Value.
	<i>Number.</i>		<i>Number.</i>	
Cattle	342,689	\$31,668,909	303,539	\$27,737,770
Hogs	930	7,387	24	180
Horses	21,819	3,262,115	24,288	3,172,798
Sheep	122,784	883,825	95,399	692,737
	<i>Pounds.</i>		<i>Pounds.</i>	
Hides and skins (other than furs)	180,347	19,319	294,393	31,564
Sole leather	29,902,604	5,109,057	32,089,378	5,398,991
Other leather		8,884,614		10,802,144
Boots and shoes		349,090		710,134
Canned beef	22,322,278	2,055,368	28,454,654	2,604,291
Fresh beef	236,414,209	22,562,155	319,834,656	27,950,180
Salted, pickled, and other cured beef	21,401,576	1,249,597	19,324,965	1,185,936
Tallow	45,060,294	1,759,270	39,822,556	1,769,373
Bacon	449,795,080	34,333,973	401,158,150	30,589,831
Hams	164,389,154	15,215,209	178,322,522	17,455,779
Pork	61,903,739	4,025,464	89,465,150	5,817,416
Lard	231,525,366	13,866,718	217,172,843	13,264,493
Oleo and oleomargarine	8,894,144	522,567	7,305,941	494,077
Butter	6,847,850	1,125,391	17,001,068	2,869,580
Cheese	25,413,146	2,139,905	29,272,702	2,797,035
Total		149,039,783		155,555,299

EXPORTS TO GERMANY.

Our exports of animal products to Germany in 1899 were valued at \$21,820,005, being a decrease from the previous year of \$3,061,370. The largest item of export is lard, the quantity in 1899 being 207,764,222 pounds, valued at \$12,509,371, as against 238,680,471 pounds, valued

*Quantity and value of imports of butter into the United Kingdom, by countries,
1895 to 1899, inclusive—Continued.*

VALUE—Continued.

Country of export.	1895.	1896.	1897.	1898.	1899.
Australasia—Continued.	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Victoria	4,782,222	3,745,730	3,973,005	2,947,206	5,116,434
New Zealand	1,138,805	1,352,391	1,785,791	1,646,824	2,644,296
Aden		49	204		
Canada	746,526	1,653,363	2,164,921	3,221,297	5,421,067
Cape of Good Hope		204		3,436	
Channel Islands	7,178	8,682	5,027	6,258	
Gibraltar					
British East Indies	6,229	6,492	10,492	13,232	
Malta	1,100			63	
Newfoundland	12,030			462	
Total	69,334,155	74,673,366	77,455,674	77,678,005	88,799,576

^a Including \$6,194,408, the value of butter imported from such of the above countries as to which the information is incomplete.

Herewith is given a table showing the quantity and value of imports of wool, by countries, for the years 1894 to 1898, inclusive. The total imports for 1898, although not so great as in 1897, amounted to the enormous sum of 694,299,733 pounds. New Zealand furnished 135,857,500 pounds, New South Wales 152,658,462 pounds, and Cape of Good Hope 69,635,158 pounds. The United States had a very small share in this trade, furnishing but 943,232 pounds. The United Kingdom does not consume all of this enormous quantity, as the statement below shows that about half of it is reexported:

Year.	Imports.	Reexported.
	<i>Pounds.</i>	<i>Pounds.</i>
1894	704,467,947	345,927,043
1895	775,379,063	404,935,226
1896	718,537,253	334,691,803
1897	740,748,963	371,502,812
1898	694,299,733	283,317,748

*Quantity and value of imports of wool¹ into the United Kingdom, by countries,
1894 to 1898, inclusive.*

QUANTITY.

Country of export.	1894.	1895.	1896.	1897.	1898.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Argentina	7,955,835	11,251,620	7,239,648	12,338,050	17,580,717
Belgium	5,871,148	7,885,168	11,391,012	9,609,019	10,742,655
Chile	5,142,576	5,386,750	7,167,530	7,994,674	12,994,638
China	3,689,340	4,264,400	2,187,000	1,603,860	3,667,020
Denmark	2,032,606	2,637,297	1,120,832	1,822,208	1,232,619
Egypt	2,459,618	4,397,940	3,145,630	2,701,805	2,442,722

¹ Includes wool of lambs and the alpaca.

EXPORTS TO FRANCE.

Our exports to France showed an increase of value for 1899 of \$1,383,020. The total was \$4,439,371, as against \$2,856,351 in 1898. There was an increase over 1898 of \$187,188 in leather, \$433,909 in boots and shoes, \$29,429 in canned beef, \$126,694 in tallow, \$535,194 in bacon, \$44,379 in hams, and \$565,137 in lard. There was a decrease in values from 1898 of \$31,094 in hides and skins, and \$8,914 (nearly 50 per cent) in salted and other cured beef. In France, as in Germany, lard is the principal item imported from the United States. In 1899, 35,003,185 pounds, valued at \$2,002,760, were taken, and in 1898, 25,599,190 pounds, valued at \$1,437,623.

Quantity and value of animals and animal products purchased by France from the United States in the calendar years 1898 and 1899.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Kind of goods	1898.		1899.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.	Dollars.	Pounds.	Dollars.
Horses.....number.....			687	99,330
Hides and skins (other than furs).....	496,156	49,813	105,168	18,719
Leather.....		297,541		484,729
Boots and shoes.....		67,426		101,335
Canned beef.....	385,364	31,267	673,577	60,696
Salted, pickled, and other cured beef.....	310,175	18,463	173,200	9,549
Tallow.....	11,480,863	453,500	14,009,982	580,194
Bacon.....	5,934,342	423,536	14,353,473	958,730
Hams.....	718,017	69,204	1,237,167	113,583
Pork.....	144,875	7,978	165,391	9,746
Lard.....	25,599,190	1,437,623	35,003,185	2,002,760
Total.....		2,856,351		4,439,371

EGGS.

The Treasury reports do not specify the countries which import eggs from the United States, but it is gratifying to learn that our exports in the aggregate have very much more than doubled over those of 1898. The accompanying table shows that the value of our eggs exported in 1892 was \$34,851, whereas in 1899 the value was \$816,851. For several years previous to 1896 our imports of eggs exceeded our exports by many thousands of dollars; but in 1896 there was a small balance in favor of exports, and during the last three years the rise in the quantity of exports has been remarkable. Our exports in 1899 exceeded those of the previous year by 1,249,520 dozens, the difference in value being \$421,973.

Imports and exports of eggs from 1892 to 1899, inclusive.

Calendar year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Dozens.</i>	<i>Dollars.</i>	<i>Dozens.</i>	<i>Dollars.</i>
1892.....	3,373,686	379,516	193,742	34,851
1893.....	2,457,576	284,178	151,311	43,098
1894.....	1,641,901	160,437	174,523	28,258
1895.....	1,954,962	219,459	181,754	29,346
1896.....	677,359	56,004	405,182	63,460
1897.....	190,674	9,259	2,734,218	424,819
1898.....	129,711	6,531	2,356,474	394,982
1899.....	259,106	24,628	4,595,994	816,855

MEAT AND MEAT PRODUCTS.

A tabular statement of exports of meat and meat products, with countries to which exported, appears on page 432. This table shows that the exports of canned beef products were 49,393,218 pounds, valued at \$4,529,550, being an increase over the previous year of 11,526,586 pounds and of \$1,081,310. While our exports have increased, it will be seen by the accompanying table that they are still below those of 1896.

Exports of canned beef, 1896-1899.

Calendar year.	Quantity.		Value.
	<i>Pounds.</i>	<i>Dollars.</i>	
1896.....	61,168,927	5,335,283	
1897.....	42,804,831	3,728,667	
1898.....	37,866,632	3,448,240	
1899.....	49,393,218	4,529,550	

The increase in fresh-beef exports was still more satisfactory. The total amount sent out in 1899 was 322,635,630 pounds, valued at \$28,194,697, an increase over 1898 of 55,176,724 pounds and of \$5,550,657. The United Kingdom took 28,454,654 pounds. The next largest item was the shipment of 11,711,921 pounds to Africa. Germany took 2,708,907 pounds. The table below affords a comparison of the exports of fresh beef for the last four years:

Exports of fresh beef, 1896-1899.

Calendar year.	Quantity.		Value.
	<i>Pounds.</i>	<i>Dollars.</i>	
1896.....	282,925,463	22,498,251	
1897.....	279,882,590	22,268,328	
1898.....	267,458,906	22,644,040	
1899.....	322,635,630	28,194,697	

In the matter of salted, pickled, or other cured beef, the reports show a decrease from the exports of 1898 of 2,667,146 pounds and of

\$119,476 in value. The total exports in 1899 were 46,065,647 pounds, valued at \$2,617,828. Of this product, the United Kingdom took nearly half; large quantities were taken by Germany, British North America, and the West Indies and Bermuda. The table below shows that while the exports have been gradually increasing during the last three years they are still far below the exports of 1896:

Exports of salted, pickled, or other cured beef, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	85,893,296	4,707,094
1897.....	43,854,117	2,244,568
1898.....	48,724,793	2,737,304
1899.....	46,065,647	2,617,828

The exports of tallow show a decrease of 9,606,004 pounds, but better prices gave an increase in value of \$74,356. The quantity exported was 97,213,186 pounds, the value being \$4,283,751. England, France, and Germany were the leading purchasers. A comparison with other years is shown in the following table:

Exports of tallow, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	85,449,086	3,336,111
1897.....	55,609,066	2,029,735
1898.....	106,819,190	4,209,395
1899.....	97,213,186	4,283,751

Our exports of bacon were less than in 1898 by 61,677,847 pounds, the difference in value being \$4,777,126. The United Kingdom took 48,640,930 pounds less than in 1898. The people of the United Kingdom require a peculiar kind of bacon, not difficult to make, yet our people have not fully met their requirements in that matter. Therefore the little kingdom of Belgium, which, it is stated, uses corn imported from the United States as feed, has in the United Kingdom a market for all the bacon she can make at prices always above those received by us. An article in the Fourteenth Annual Report of this Bureau describes the manner of curing bacon to suit the English taste.

Exports of bacon, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	436,859,660	31,057,506
1897.....	578,082,822	39,820,382
1898.....	619,683,235	45,786,045
1899.....	558,005,388	41,008,919

Better prices ruled abroad for our hams in 1899 than in 1898. During the year we exported 216,646,559 pounds, valued at \$21,015,536, as against 220,011,750 pounds, valued at \$20,384,650, in 1898. This represented a decrease in quantity of 3,364,191 pounds and an increase in value of \$630,886. The United Kingdom took 178,322,522 pounds, being more than half of the total exports. The following table shows the quantity and value of exports of hams for the years 1896 to 1899, inclusive:

Exports of hams, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	156,912,852	15,224,842
1897.....	171,956,663	16,581,639
1898.....	220,011,750	20,384,650
1899.....	216,646,559	21,015,536

The table below concerning the exports of pork show that the increase in amount and value has been gradual. Our total exports in 1899 were 171,615,148 pounds, the value of which was \$10,331,620. The increase over 1898 was 34,384,284 pounds and \$1,514,255. This increase is principally due to the United Kingdom, which took 27,561,411 more pounds of pork in 1899 than in 1898, and to Germany, which increased her purchases 3,555,385 pounds over 1898. The purchases of British North America were about 4,000,000 pounds less in 1899 than in 1898:

Exports of pork, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	63,859,513	3,223,147
1897.....	72,949,589	3,653,182
1898.....	147,231,864	8,827,365
1899.....	171,615,148	10,331,620

Our exports of lard were not so great in 1898 as in 1899 by 46,567,553 pounds; the decrease in value was \$1,909,028. The total amount exported was 690,068,669 pounds, valued at \$41,531,142. The United Kingdom took 217,172,843 pounds—14,352,523 pounds less than in the previous year; the value, however, was only \$602,225 less. France increased her purchases from 25,599,190 pounds in 1898 to 35,003,185 pounds in 1899, a difference of 9,403,995 pounds. Germany purchased but 207,764,222 pounds in 1899, as against 238,680,471 pounds in the previous year, making a decrease of 30,916,249 pounds. For British North America the reduction from 10,801,182 pounds in 1898 to 740,008 in 1899 is striking. The Cuban imports of our lard increased

from 19,890,106 pounds in 1898 to 32,378,420 pounds in 1899. The table herewith affords a comparison of our total exports of lard for the last four years:

Exports of lard, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	536,320,203	29,821,308
1897.....	630,030,611	32,822,409
1898.....	738,636,222	43,440,170
1899.....	690,068,069	41,531,142

There has been a gradual increase from year to year in our exports of oleo and oleomargarine until in 1899 we sent abroad 144,438,709 pounds, valued at \$10,241,347. This was an increase over the previous year of 2,166,377 pounds and of \$1,586,626. Germany and Netherlands are our principal patrons in this product, the former taking 27,928,997 pounds in 1899 and the latter 81,324,948 pounds. Both countries took less, however, than in the previous year. A comparison of total exports for the last four years is shown in the following table:

Exports of oleo and oleomargarine, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	120,686,367	8,255,849
1897.....	122,055,911	7,391,001
1898.....	142,272,339	8,654,721
1899.....	144,438,709	10,241,347

Our butter exports, which in 1897 amounted to 30,914,783 pounds and in 1898 fell to 15,034,189 pounds, rose to about the usual amount in 1899—namely, 27,309,869 pounds. The gain in quantity over 1898 was 12,275,680 pounds and in value \$1,074,601. We imported butter during the year to the amount of 29,337 pounds, valued at \$5,112. This is a slight increase over 1898, but a decrease from 1897. A comparison of total exports for the last four years is shown in the following table:

Exports of butter, 1896-1899.

Calendar year.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	27,220,213	3,909,900
1897.....	30,914,783	4,497,878
1898.....	15,034,189	2,428,143
1899.....	27,309,869	4,502,744

There was a heavy decrease from 1898 in the quantity of cheese exported, the balance against us being 5,837,161 pounds. Better prices, however, gave for the 34,686,833 pounds exported in 1899 the same amount that was received for the 40,523,994 pounds exported in 1898. We imported 13,167,367 pounds, valued at \$1,710,832, as against 10,850,075 pounds, valued at \$1,457,195, in 1898. This is an increase of 2,317,292 pounds. The imports and exports for four years are shown in the following table:

Imports and exports of cheese, 1896-1899.

Calendar year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>	<i>Pounds.</i>	<i>Dollars.</i>
1896.....	11,349,856	1,547,741	44,530,234	3,846,703
1897.....	11,192,754	1,495,837	60,180,651	5,432,371
1898.....	10,850,075	1,457,195	40,523,994	3,376,818
1899.....	13,167,367	1,710,832	34,686,833	3,376,108

Quantity and value of exports of meat, meat products, and dairy products for the calendar year 1899, by countries.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Country to which exported.	Quantity.	Value.	Country to which exported.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>		<i>Pounds.</i>	<i>Dollars.</i>
Canned beef:			Canned beef—Cont'd.		
United Kingdom	28,454,654	2,604,291	Africa.....	11,711,921	1,022,412
France.....	673,577	63,696	Other countries.....		
Germany.....	2,708,907	244,410	Total.....	49,393,218	4,529,550
Other Europe.....	2,368,258	211,517			
British North America.....	656,317	54,442	Fresh beef:		
Central American States and British Honduras.....	267,120	26,619	United Kingdom	319,834,656	27,950,180
Mexico.....	181,092	22,800	British North America.....	9,915	749
Santo Domingo.....	1,174	118	West Indies and Bermuda.....	2,244,009	200,193
Cuba.....	156,606	13,464	Other countries.....	536,960	43,575
Porto Rico.....	7,462	609	Total.....	322,635,630	28,194,697
Other West Indies and Bermuda.....	375,321	37,217	Salted, pickled, or other cured beef:		
Argentina.....	15,518	1,484	United Kingdom.....	19,324,965	1,185,936
Brazil.....	282,801	28,810	France.....	173,200	9,519
Colombia.....	92,211	8,297	Germany.....	4,946,814	262,843
Other South America.....	200,770	19,597	Other Europe.....	5,293,588	293,918
China.....	137,948	16,879	British North America.....	4,304,043	210,757
East Indies (British).....	44,811	5,155	Central American States and British Honduras.....	750,059	39,371
Hongkong.....	150,598	22,093	Mexico.....	23,868	2,151
Japan.....	187,058	23,528	Santo Domingo.....	106,650	5,800
British Australasia.....	38,912	4,017	Cuba.....	461,039	24,499
Philippine Islands.....	81,550	11,959	Porto Rico.....	30,200	1,955
Other Asia and Oceania.....	598,662	80,046	Other West Indies and Bermuda.....	5,640,691	297,562

Quantity and value of exports of meat, meat products, and dairy products for the calendar year 1899, by countries—Continued.

Country to which exported.	Quantity.	Value.	Country to which exported.	Quantity.	Value.
Salted, pickled, or other cured beef—Continued.	<i>Pounds.</i>	<i>Dollars.</i>	Bacon—Continued.	<i>Pounds.</i>	<i>Dollars.</i>
Brazil	91,870	4,410	Other South America	174,615	12,380
Colombia	309,090	19,446	China	72,032	8,893
Other South America	2,959,420	166,454	Philippine Islands	5,900	711
Asia and Oceania	895,500	59,006	Other Asia and Oceania	647,224	56,611
Africa	661,335	33,060	Africa	89,506	6,654
Other countries	19,300	1,111	Other countries		
Total	46,065,647	2,617,828	Total	558,005,388	41,008,919
Tallow:			Hams:		
United Kingdom	39,822,556	1,760,373	United Kingdom	178,322,522	17,455,779
France	14,009,982	580,194	France	1,237,167	113,583
Germany	11,565,329	521,174	Germany	6,570,591	620,167
Other Europe	24,844,836	1,083,097	Other Europe	15,178,559	1,374,448
British North America	175,248	6,682	British North America	2,397,746	224,589
Central American States and British Honduras	1,861,230	86,527	Central American States and British Honduras	285,066	27,819
Mexico	601,051	27,606	Mexico	358,849	40,591
Santo Domingo	400,827	17,725	Santo Domingo	59,509	6,707
Cuba	66,654	3,330	Cuba	7,976,828	722,314
Porto Rico	10,840	702	Porto Rico	293,444	26,521
Other West Indies and Bermuda	1,329,904	69,175	Other West Indies and Bermuda	1,779,463	163,720
Brazil	437,109	24,847	Brazil	35,479	3,958
Colombia	342,664	18,426	Colombia	215,874	18,588
Other South America	1,042,608	49,909	Other South America	799,195	84,930
Asia and Oceania	605,179	23,621	China	105,573	13,088
Other countries	97,169	5,273	British Australasia	164,831	16,985
Total	97,213,186	4,283,751	Philippine Islands	49,710	5,933
Bacon:			Other Asia and Oceania	566,862	70,059
United Kingdom	401,158,150	30,589,831	Africa	227,107	24,001
France	14,353,473	958,730	Other countries	22,064	1,756
Germany	33,289,598	2,339,825	Total	216,646,559	21,015,536
Other Europe	83,873,962	5,545,275	Canned, fresh and salted or pickled pork:		
British North America	3,077,852	232,568	United Kingdom	89,465,150	5,817,416
Central American States and British Honduras	299,638	21,909	France	165,391	9,746
Mexico	221,127	21,743	Germany	16,473,445	900,796
Santo Domingo	35,081	2,190	Other Europe	22,048,016	1,317,356
Cuba	16,093,581	902,091	British North America	13,553,860	721,936
Porto Rico	1,207,813	78,456	Central American States and British Honduras	1,427,536	68,686
Other West Indies and Bermuda	472,377	36,935	Santo Domingo	144,400	7,548
Brazil	2,964,057	191,959	Cuba	3,107,742	182,549
Colombia	29,402	2,156	Porto Rico	3,977,800	205,608

Quantity and value of exports of meat, meat products, and dairy products for the calendar year 1899, by countries—Continued.

Country to which exported.	Quantity.	Value.	Country to which exported.	Quantity.	Value.
Canned, fresh and salted or pickled pork—Continued.			Oleo and oleomargarine—Continued.		
Other West Indies and Bermuda.....	<i>Pounds.</i>	<i>Dollars.</i>	British North America.....	<i>Pounds.</i>	<i>Dollars.</i>
Brazil.....	15,938,314	824,027	Central American States and British Honduras.....	775,988	50,390
Colombia.....	54,750	3,063	Mexico.....	43,609	4,685
Other South America.....	625,899	32,082	Porto Rico.....	9,918	984
Philippine Islands.....	3,949,723	199,963	Other West Indies and Bermuda.....	293,041	29,413
Asia and Oceania.....	5,990	434	Colombia.....	2,429,980	240,227
Africa.....	170,290	13,422	Other South America.....	133,899	11,925
Other countries.....	274,900	14,156	Philippine Islands.....	226,076	24,006
Total.....	231,963	12,884	Asia and Oceania.....	1,940	152
Lard:	171,615,148	10,331,620	Other countries.....	839,879	85,363
United Kingdom.....	217,172,843	13,264,403	Total.....	164,056	10,481
France.....	35,003,185	2,002,760	Poultry and game.....	144,438,709	10,241,347
Germany.....	207,764,222	12,509,371	All other meat products:		
Other Europe.....	143,990,089	8,519,284	Canned.....		779,373
British North America.....	740,008	47,147	Other.....		5,040,582
Central American States and British Honduras.....	2,938,060	172,391	Butter:		
Mexico.....	5,845,599	329,480	United Kingdom.....	17,001,068	2,809,590
Santo Domingo.....	395,384	24,392	Germany.....	872,921	137,546
Cuba.....	32,378,420	1,809,799	Other Europe.....	1,046,569	152,600
Porto Rico.....	4,528,235	250,976	British North America.....	1,968,424	325,575
Other West Indies and Bermuda.....	5,569,094	372,478	Central American States and British Honduras.....	265,534	50,420
Argentina.....	72,251	4,301	Mexico.....	278,945	50,132
Brazil.....	14,673,385	992,515	Santo Domingo.....	51,816	8,205
Colombia.....	2,231,384	137,541	Cuba.....	585,441	99,129
Other South America.....	11,149,215	711,978	Porto Rico.....	23,299	5,050
Philippine Islands.....	58,450	4,546	Other West Indies and Bermuda.....	1,877,297	310,027
Asia and Oceania.....	2,653,927	162,285	Brazil.....	1,837,451	226,109
Africa.....	2,902,533	212,478	Colombia.....	85,585	16,006
Other countries.....	38,385	2,327	Other South America.....	1,660,995	173,470
Total.....	690,068,669	41,531,142	China.....	26,397	5,927
Lard compounds and substitutes (cotton-lene, lardine, etc.).....	24,753,838	1,320,737	Japan.....	87,575	18,840
Casings for sausages.....		1,899,154	Philippine Islands.....	12,475	3,041
Mutton.....	719,309	57,290	Other Asia and Oceania.....	203,142	45,630
Oleo and oleomargarine:			Africa.....	9,891	2,089
United Kingdom.....	7,305,941	494,077	Other countries.....	22,164	3,368
Germany.....	27,928,997	2,121,601	Total.....	27,309,869	4,502,744
Netherlands.....	81,324,948	5,531,824			
Other Europe.....	22,987,476	1,641,219			

Quantity and value of exports of meat, meat products, and dairy products for the calendar year 1899, by countries—Continued.

Country to which exported.	Quantity.	Value.	Country to which exported.	Quantity.	Value.
<i>Cheese:</i>	<i>Pounds.</i>	<i>Dollars.</i>	<i>Cheese—Continued.</i>	<i>Pounds.</i>	<i>Dollars.</i>
United Kingdom	29,272,702	2,797,035	Colombia	65,251	8,443
Germany	1,864	210	Other South America	107,189	13,725
British North America	2,829,223	265,013	China	62,800	6,963
Central American States and British Honduras	162,218	20,445	Japan	55,809	6,307
Mexico	211,590	26,006	Philippine Islands	16,432	2,021
Santo Domingo	41,075	5,304	Other Asia and Oceania	328,634	37,644
Cuba	525,127	62,590	Other countries	23,371	2,518
Porto Rico	301,346	36,942	Total	34,686,833	3,376,108
Other West Indies and Bermuda	680,090	84,690	Milk		1,188,067
Brazil	2,002	252			

WOOL, WOOL MANUFACTURES, ETC.

The imports of wool and wool manufactures have increased in value to the extent of \$835,619. In 1898 the value of clothing wool imported was \$4,639,220, which was a reduction from 1897 of \$29,314,608. The value for 1899 was still further reduced to the comparatively small sum of \$2,803,680. The value of combing wool imported increased over 1898 to the amount of \$1,197,939. Carpet wool shows an increase over the previous year of \$710,669, and manufactures of wool, \$762,551. The total value of the imports of wool and wool manufactures amounted in value to \$26,256,491, as against \$25,420,872 in 1898. The accompanying table shows the value of our imports since 1892:

Value of imports of wool and wool manufactures for the years 1892 to 1899, inclusive.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Calendar year.	Class 1 (clothing wool).	Class 2 (combing wool).	Class 3 (carpet wool).	Manu- factures.	Total
1892	\$9,309,640	\$1,375,651	\$10,505,348	\$37,515,445	\$58,703,084
1893	5,373,238	895,266	7,485,045	30,238,505	44,182,055
1894	5,315,919	1,166,150	6,780,443	17,342,682	30,605,194
1895	19,657,912	4,062,656	10,019,591	60,319,331	94,089,490
1896	13,077,712	2,632,169	7,311,523	37,109,363	59,530,777
1897	33,953,828	6,946,102	12,532,300	29,330,284	82,762,214
1898	4,639,220	301,337	6,646,019	13,834,296	25,420,872
1899	2,803,680	1,499,276	7,356,688	14,599,847	26,256,491

Our exports of raw wool have increased in value from \$14,406 in 1898 to \$566,295 in 1899, and the exports of manufactures from \$1,020,810 in 1898 to \$1,229,539 in 1899. A comparative statement of

the exports of raw wool and wool manufactures for the years 1892 to 1899 is shown in the table below:

Exports of wool and wool manufactures, 1892-1899.

Calendar year.	Raw wool.	Manufac- tures.	Total.
1892.....	\$38,799	\$273,835	\$312,634
1893.....	36,130	559,379	595,518
1894.....	232,162	736,360	968,522
1895.....	689,874	782,855	1,472,729
1896.....	968,866	945,103	1,913,969
1897.....	144,608	1,058,956	1,203,564
1898.....	14,406	1,020,810	1,035,216
1899.....	506,295	1,229,539	1,795,834

Quantity and value of imports and exports of wool and wool manufactures (including hair of goat, camel, etc.) for the calendar year 1899.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

IMPORTS.

Country from which imported or to which exported.	Quantity.	Value.
CLASS 1.—Clothing wool.		
	<i>Pounds.</i>	<i>Dollars.</i>
United Kingdom.....	8,188,503	1,307,233
France.....	51,072	4,666
South America.....	4,518,713	544,593
Asia and Oceania.....	3,791,545	702,049
Other countries.....	1,659,123	245,139
Total.....	18,209,046	2,803,680
CLASS 2.—Combing wool.		
United Kingdom.....	5,163,403	1,078,549
Other Europe.....	765,133	272,961
British North America.....	858,510	147,030
South America.....	1,471	101
Asia and Oceania.....	60	7
Other countries.....	5,229	628
Total.....	6,793,806	1,499,276
CLASS 3.—Carpet wool.		
United Kingdom.....	25,550,607	2,702,329
France.....	2,446,438	240,831
Germany.....	1,379,186	139,965
Other Europe.....	17,604,550	1,740,010
British North America.....		
South America.....	7,731,610	575,877
China.....	21,436,486	1,462,144
Other Asia and Oceania.....	4,701,555	494,907
Other countries.....	14,290	625
Total.....	80,864,722	7,356,688
Manufactures (all countries).....		14,590,847

Quantity and value of imports and exports of wool and wool manufactures (including hair of goat, camel, etc.) for the calendar year 1899—Continued.

IMPORTS—Continued.

Country from which imported or to which exported.	Quantity.	Value.
CLASS 3.—Carpet wool—Continued.		
Carpets:	<i>Sq. yards.</i>	<i>Dollars.</i>
United Kingdom	254,903	601,427
Other Europe	382,446	1,271,183
Japan	3,277	3,302
Other Asia and Oceania	119,723	396,136
Other countries	494	367
Total	700,843	2,272,415
Cloth:	<i>Pounds.</i>	
United Kingdom	3,308,742	3,230,204
Austria-Hungary	64,334	61,465
Belgium	176,308	155,331
France	165,707	216,681
Germany	950,058	910,277
Other Europe	6,765	6,714
Other countries	4,506	3,722
Total	4,676,510	4,584,304
Dress goods:	<i>Sq. yards.</i>	
United Kingdom	12,310,975	2,386,761
France	6,361,618	1,889,400
Germany	4,906,564	1,162,665
Other Europe	81,593	21,142
Other countries	394	196
Total	23,661,144	5,460,164

EXPORTS.

Raw wool	<i>Pounds.</i>	<i>Dollars.</i>
	3,511,001	566,295
Manufactures:	<i>Sq. yards.</i>	
Carpets	128,916	97,363
Dress goods	44,311	28,608
Flannels and blankets		55,294
Wearing apparel		590,061
All other		468,213
Total		1,220,539

HIDES AND SKINS.

The imports of hides and skins (other than furs) in 1899 amounted to 318,261,631 pounds, with a value of \$51,127,659. This is an increase over 1897 of 62,072,661 pounds and of \$11,221,286. The increase of 1898 over 1897 was only about 20,000,000 pounds. Our imports from

the United Kingdom declined somewhat from 1898, but there was an increase from France, Germany, British North America, Mexico, South America, and East Indies. The table given below shows the quantities and values of hides and skins, and the country of export or import. Our exports of these goods fell in 1899 to 7,514,483 pounds from 11,397,129 pounds in 1898. In 1897 the exports were 18,778,031 pounds. The country which took the largest quantity of these exports was Germany, the amount being 3,880,000 pounds, valued at \$339,561. British North America took 2,730,580 pounds, valued at \$291,233. The total amount of exports was 7,514,483 pounds and the value was \$769,927.

Quantity and value of imports and exports of hides and skins (other than furs) for the calendar year 1899.

Country from which imported or to which exported.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.	Dollars.	Pounds.	Dollars.
United Kingdom	49,834,750	6,685,305	284,393	31,564
France	26,393,575	5,058,120	105,168	18,719
Germany	33,605,405	5,119,263	3,880,000	339,561
Other Europe	43,492,307	6,554,082	442,740	79,514
British North America	16,610,822	1,531,227	2,730,580	291,233
Central American States	2,938,642	267,423		
Mexico	13,297,128	2,102,194	16,641	2,503
West Indies and Bermuda	2,876,181	453,614	6,702	940
Japan			36,559	5,843
Other Asia and Oceania	9,986,723	2,236,338		
Africa	7,096,093	1,321,588		
South America	64,594,751	10,674,348		
East Indies	34,559,868	6,984,020		
Other countries	12,975,388	2,040,128	3,700	550
Total	318,261,631	51,127,059	7,514,483	769,927

The tabular statement below shows the imports and exports for the four years 1896 to 1899, inclusive:

Imports and exports of hides and skins, 1896-1899.

Calendar year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.	Dollars.	Pounds.	Dollars.
1896	146,159,006	20,713,528	42,009,166	3,481,364
1897	236,372,088	33,230,749	18,778,031	1,553,622
1898	256,188,970	39,906,373	11,397,129	1,018,433
1899	318,261,631	51,127,059	7,514,483	769,927

*Quantity and value of imports and exports of leather and leather manufactures
for the calendar year 1899.*

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

IMPORTS.

Country from which imported or to which exported.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
Leather:		
Band or belting and sole leather		40,731
Calfskins, tanned, etc		143,176
Skins for morocco		2,831,035
Upper leather and skins, dressed, etc		2,726,902
Total		5,750,934
Leather manufactures:		
Gloves—		
Belgium		278,001
France		2,104,747
Germany		2,429,305
Other Europe		732,485
Other countries		333
All other		598,513
Total		6,143,384

EXPORTS.

Sole leather:		
United Kingdom	32,080,378	5,308,991
Germany	309,433	63,141
Other Europe	3,505,299	678,753
British North America	1,078,149	210,529
West Indies and Bermuda	43,954	9,122
South America	23,834	5,263
Japan	1,042,701	244,150
British Australasia	200,794	46,424
Philippine Islands	560	127
Other Asia and Oceania	370,789	81,963
Africa	189,256	35,740
Other countries	49,067	11,022
Total	38,883,814	6,788,209
Other leather:		
United Kingdom		10,802,144
France		484,729
Germany		972,655
Other Europe		1,512,610
British North America		730,216
Central American States and British Honduras		13,525
Mexico		25,289
Santo Domingo		1,074
Cuba		31,797
Porto Rico		8,203
Other West Indies and Bermuda		29,137
Argentina		51,707
Brazil		78,439
Colombia		3,964
Other South America		38,577
British Australasia		425,374

Quantity and value of imports and exports of leather and leather manufactures for the calendar year 1899—Continued.

EXPORTS—Continued.

Country from which imported or to which exported.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>
Other leather—Continued.		
Philippine Islands		2,420
Other Asia and Oceania		68,849
Africa		34,606
Other countries.....		927
Total.....		15,316,242
Boots and shoes:		
United Kingdom.....		710,134
France		44,845
Germany		101,335
Other Europe		66,755
British North America		440,772
Central American States and British Honduras.....		143,402
Mexico.....		325,265
West Indies and Bermuda		648,507
Colombia		46,660
Other South America.....		31,815
British Australasia		753,881
Philippine Islands.....		1,575
Other Asia and Oceania		201,990
Africa.....		149,491
Other countries		2,108
Total.....		3,668,435
Harness and saddles		296,145
All other manufactures.....		740,802

LEATHER AND LEATHER MANUFACTURES.

The value of the imports of leather was \$5,750,934, showing an increase over the previous year of \$514,763 and a decrease from 1897 of \$622,792. Of leather manufactures we imported \$6,143,384 worth, as against \$6,110,644 in 1898 and \$6,789,576 in 1897. The accompanying table shows that of the \$6,143,384 representing the imports of leather manufactures, \$5,544,871 was for the one item of gloves. From France we purchased \$2,104,747 worth and from Germany \$2,429,305 worth.

All kinds of leather considered, our exports exceeded our imports. We exported 38,883,814 pounds of sole leather, receiving for it \$6,788,209. Of this amount the United Kingdom alone took 32,089,378 pounds, valued at \$5,398,991. Of other kinds of leather our exports amounted in value to \$15,316,242, an increase over 1898 of \$3,073,974 and over 1897 of \$4,919,852. The United Kingdom purchased \$10,802,144 worth from us, being about two-thirds of the total amount exported.

There was a large increase in the exports of boots and shoes, the value being \$3,668,435, and an increase over 1898 of \$1,724,012. Our

largest purchasers were the United Kingdom, British Australasia, West Indies and Bermuda, and British North America.

There was an increase in the value of harness and saddles exported from \$212,695 in 1898 to \$296,145 in 1899.

MISCELLANEOUS EXPORTS.

Other items, which are shown in the table herewith and not included in the preceding statements, were exported in 1899 to the value of \$4,724,835. Among these items is that of grease, grease scraps, etc., which amounted in value to \$2,276,691.

Exports of miscellaneous articles for the calendar year 1899.

Bones, hoofs, horns, etc.....	\$191,474
Candles	250,740
Feathers	258,365
Glue	229,815
Grease, grease scraps, etc.....	2,746,691
Hair and hair manufactures	585,305
Lard oil	462,441

NUMBER OF LIVE STOCK IN FOREIGN COUNTRIES.

The information in this article, showing the number of live stock in various foreign countries for various years, is taken from the report of the Board of Agriculture of Great Britain for the year 1899:

UNITED KINGDOM.

Country and year.	Horses.	Cattle.	Sheep.	Hogs.
England:				
1801.....	1,143,050	4,870,215	17,874,722	2,461,185
1802.....	1,169,140	4,938,590	17,993,756	1,828,542
1803.....	1,173,809	4,744,059	16,805,299	1,793,056
1804.....	1,176,248	4,450,607	15,549,995	2,023,323
1805.....	1,184,747	4,472,565	15,557,571	2,471,029
1806.....	1,190,038	4,573,603	16,031,095	2,476,498
1807.....	1,168,763	4,567,834	15,721,213	1,990,534
1808.....	1,163,625	4,674,303	15,883,538	2,078,898
1809.....	1,163,812	4,841,852	16,261,417	2,225,629
Wales:				
1801.....	150,186	759,309	3,233,936	270,082
1802.....	148,827	754,467	3,197,501	197,342
1803.....	147,344	738,608	3,101,890	206,676
1804.....	147,506	695,000	3,078,641	227,598
1805.....	153,158	763,824	3,000,841	280,001
1806.....	155,965	712,979	3,207,815	257,628
1807.....	153,282	709,120	3,195,356	216,467
1808.....	151,954	701,777	3,268,708	238,521
1809.....	153,974	736,691	3,416,367	238,154
Scotland:				
1801.....	195,167	1,223,297	7,623,900	157,566
1802.....	200,109	1,221,736	7,543,447	112,015
1803.....	203,374	1,218,009	7,373,161	119,398
1804.....	205,707	1,201,506	7,272,864	148,586
1805.....	207,323	1,177,947	7,233,783	133,329
1806.....	206,504	1,207,000	7,460,419	144,615
1807.....	204,379	1,223,543	7,423,868	135,321
1808.....	201,581	1,246,284	7,587,948	124,116
1809.....	198,844	1,217,177	7,560,980	145,229
Ireland:				
1808.....	513,788	4,486,242	4,287,374	1,253,622
1809.....	501,982	4,507,272	4,364,076	1,363,311
Isle of Man and Channel Islands:				
1808.....	9,382	40,506	61,891	13,842
1809.....	9,480	41,704	77,395	16,465

*Number of live stock in foreign countries—Continued.*BRITISH INDIA. ^a

Year.	Cattle (except calves).	Buffaloes (except calves).	Calves and buffalo calves.	Sheep.
1895.....	49,113,723	11,777,858	17,488,539	17,214,888
1896.....	49,026,996	11,793,475	17,759,317	17,231,118
1897.....	47,348,343	11,510,529	17,385,569	16,875,724
1898.....	48,539,668	11,738,857	17,830,872	17,300,540

Year.	Horses and ponies.	Mules and asses.	Goats.	Camels.
1895.....	1,132,636	1,101,586	15,257,448	234,245
1896.....	1,152,270	1,120,239	15,390,037	234,481
1897.....	1,120,194	1,116,072	14,987,778	223,477
1898.....	1,109,020	1,103,182	15,594,856	226,629

^a Not including Bengal and Sind.

NEW SOUTH WALES.

Year.	Cattle.	Sheep.	Hogs.	Horses.
1895.....	1,317,315	37,820,906	298,697	344,697
1896.....	1,909,009	55,986,431	283,061	414,163
1896.....	2,150,057	47,617,687	223,597	487,943
1897.....	2,085,096	43,952,897	207,738	498,034
1898.....	2,029,516	41,241,004	247,061	491,553

QUEENSLAND.

1895.....	4,162,652	8,094,322	55,843	260,207
1896.....	5,558,294	18,007,234	96,836	365,812
1896.....	6,822,401	19,856,959	100,747	468,743
1897.....	6,089,013	17,797,883	110,855	479,280
1898.....	5,571,292	17,552,608	127,061	480,469

SOUTH AUSTRALIA.

1895.....	258,245	6,645,406	.....	163,313
1896.....	324,412	6,380,617	106,856	170,515
1896.....	359,932	7,004,642	116,277	187,696
1897.....	337,225	6,323,993	59,479	180,211
1898.....	274,255	5,032,541	46,894	164,820
1899.....	290,343	5,012,620	63,132	161,774

VICTORIA.

1891.....	1,286,267	10,360,285	241,936	275,516
1891.....	1,782,881	12,692,843	282,457	436,469
1896.....	^a 462,578	.....	.....	.....
1897.....	^a 457,024	.....	.....	.....
1898.....	^a 399,617	.....	.....	.....
1899.....	^a 413,278	.....	.....	.....

^a On dairy farms only.

BUREAU OF ANIMAL INDUSTRY.

Number of live stock in foreign countries—Continued.

WESTERN AUSTRALIA.

Year.	Cattle.	Sheep.	Hogs.	Horses.
1887.....	93,544	1,909,940	23,627	41,100
1890.....	130,970	2,524,913	28,985	44,394
1894.....	187,214	2,132,811	28,896	50,001
1895.....	200,091	2,295,832	27,015	58,506
1896.....	199,793	2,248,976	31,154	57,527
1897.....	244,971	2,210,742	31,809	62,222
1898.....	245,907	2,244,888	39,234	62,442

NEW ZEALAND.

1886.....	853,358	16,564,595	277,901	187,382
1891.....	831,831	18,128,186	306,812	211,040
1895.....	1,047,901	19,828,804	239,778	237,418
1896.....	1,138,087	19,138,493	209,834	249,613
1898.....	1,209,165	19,673,725	186,027	253,227
1899.....	1,203,024	19,348,506	193,512	258,649

TASMANIA.

1885.....	128,834	1,720,027	57,303	27,188
1890.....	150,004	1,551,429	56,632	29,778
1896.....	162,801	1,523,846	70,142	31,580
1898.....	157,486	1,588,611	43,520	29,898
1899.....	148,558	1,493,638	45,274	29,797

MANITOBA.

1881.....	60,281	6,073	17,358	16,739
1891.....	230,696	35,838	54,177	86,735
1893.....	173,250	35,400	50,700	88,000
1894.....	183,966	35,430	68,367	88,689
1895.....	192,525	35,766	59,457	91,194
1896.....	210,507	33,812	72,562	95,140
1897.....	221,775	36,680	74,944	100,274
1898.....	227,097	32,053	69,648	101,636
1899.....	220,248	33,092	68,011	102,655

ONTARIO.

1881.....	1,702,167	1,359,178	700,922	580,296
1891.....	1,940,673	1,021,769	1,121,306	771,838
1896.....	2,181,958	1,849,348	1,269,631	624,749
1897.....	2,182,326	1,690,350	1,284,963	613,670
1898.....	2,215,943	1,677,014	1,642,787	611,241
1899.....	2,318,355	1,772,604	1,971,070	615,524

Number of live stock in foreign countries—Continued.

CAPE OF GOOD HOPE.

Year.	Cattle.	Sheep.	Hogs.	Horses.
1893.....	1,969,594	16,793,972	225,407	360,499
1894.....	1,930,800	15,154,753	228,854	340,323
1895 <i>a</i>	2,062,099	15,646,486	252,953	363,598
1896 <i>a b</i>	2,303,582	14,409,434	243,027	387,590
1897 <i>a c</i>	2,231,370	14,049,076	240,643	357,960
1898 <i>a b</i>	1,201,522	12,616,883	239,451	382,610

a Including Pandoland, annexed to Cape of Good Hope in 1894.*b* Including Bechuanaland, annexed in 1895.*c* Not including Bechuanaland.

CEYLON.

1893.....	1,062,776	92,362	61,392	4,207
1894.....	1,135,433	90,660	64,860	3,965
1895.....	1,226,340	94,964	68,870	4,227
1896.....	1,253,368	83,456	71,936	4,383
1897.....	1,289,536	86,627	79,524	4,007
1898.....	1,310,447	83,620	78,168	4,127

CYPRUS.

1894.....	51,275	<i>a</i> 245,883	.....	<i>b</i> 58,412
1895.....	53,402	<i>a</i> 253,080	.....	<i>b</i> 62,673
1896.....	52,714	<i>a</i> 272,214	.....	<i>b</i> 65,170
1897.....	53,462	<i>a</i> 294,446	.....	<i>b</i> 67,407
1898.....	48,335	<i>a</i> 291,147	.....	<i>b</i> 58,159

a Exclusive of sheep under 1 year old.*b* Including mules and asses.

FALKLAND ISLANDS.

1893.....	6,200	771,305	.....	2,870
1894.....	8,192	763,244	50	3,294
1895.....	6,850	791,442	50	3,250
1896.....	6,500	761,768	200	3,031
1897.....	7,343	732,010	200	2,758
1898.....	6,651	786,398	500	3,491

JAMAICA.

1893.....	100,720	17,062	.....	70,729
1894.....	103,581	14,752	.....	68,881
1895.....	99,705	12,931	.....	46,203
1896.....	119,922	14,456	.....	46,823
1897.....	121,000	15,100	.....	48,910
1898.....	117,645	15,517	.....	53,025

Number of live stock in foreign countries—Continued.

MALTA.

Year.	Cattle.	Sheep.	Hogs.	Horses.
1893.....	7,358	13,931	.....	a 7,141
1894.....	8,062	15,232	.....	a 8,569
1895.....	7,005	14,800	.....	a 7,153
1893.....	8,023	16,716	.....	a 10,561
1897.....	7,905	15,961	.....	a 7,901
1893.....	7,850	13,895	7,058	a 8,902

a Including mules and asses.

MAURITIUS.

1884.....	15,000	a 30,000	30,000	12,000
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a Including goats.

NATAL.

1893.....	724,120	945,995	46,396	65,000
1894.....	703,396	918,827	55,943	50,700
1895.....	738,450	971,167	61,139	58,000
1893.....	738,732	844,234	44,672	51,000
1897.....	241,933	722,805	41,015	40,361
1898 a.....	278,553	600,029	36,704	57,363

a Inclusive of Zululand, annexed to Natal in 1897.

NEWFOUNDLAND.

1891.....	23,822	60,840	4,138
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AUSTRIA.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules.	Asses.	Goats.
1809.....	7,425,212	5,026,398	2,551,473	1,389,623	11,723	31,351	979,104
1880.....	8,584,077	3,841,340	2,721,541	1,463,282	12,710	36,908	1,066,655
1890.....	8,643,936	3,186,787	3,549,700	1,548,197	17,391	40,561	1,055,832

HUNGARY. a

Year.	Cattle.	Sheep.	Hogs.	Horses.	Goats.
1870.....	5,279,193	15,076,997	4,443,279	2,158,819	572,961
1880.....	5,311,378	9,838,133	4,160,127	2,078,528	338,256
1893.....	6,738,365	8,122,682	7,330,343	2,308,457	308,510

a Including Croatia and Slavonia.

BELGIUM.

1856.....	1,257,649	583,485	458,418	277,311	.....
1866.....	1,242,445	586,097	632,301	283,163	107,138
1880.....	1,382,815	365,400	646,375	271,974	248,755
1895.....	1,420,978	235,722	1,163,133	271,527	241,645

Number of live stock in foreign countries—Continued.

DENMARK.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Goats.
1881.....	1,470,078	1,548,613	527,417	347,561	9,331
1885.....	1,459,527	1,225,196	770,785	375,533	13,405
1893.....	1,096,190	1,246,552	829,131	410,630	25,266
1898.....	1,743,440	1,074,413	1,178,514	449,264	31,808

FRANCE.

Year.	Cattle.	Sheep.	Hogs.	Horses. ^a	Mules.	Asses.	Goats.
1885.....	13,104,970	22,616,547	5,881,098	2,911,392	238,620	387,227	1,483,342
1890.....	13,562,685	21,658,416	6,017,238	2,862,273	230,612	371,936	1,505,090
1895.....	13,223,828	21,163,797	6,306,019	2,812,447	211,479	357,778	1,509,502
1897.....	13,486,519	21,445,113	6,282,764	2,899,131	205,715	361,414	1,485,756
1898.....	13,418,087	21,277,582	6,230,966	2,894,379	208,227	361,728	1,501,668

^a Number on farms only.

GERMANY.

1873.....	15,776,702	24,909,406	7,124,068	3,352,231	1,636	11,069	2,320,002
1883.....	15,796,704	19,180,715	9,200,195	3,522,545	1,009	8,786	2,640,994
1892.....	17,555,694	13,590,612	12,174,288	3,858,256	383	6,320	3,091,297
1897.....	18,490,772	10,806,772	14,274,557	4,038,485	.....	.....	.....

HOLLAND.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Goats.
1890.....	1,532,800	819,300	578,700	273,100	164,800
1892.....	1,528,500	752,300	543,900	270,900	165,800
1894.....	1,508,300	695,300	640,200	263,800	167,500
1896.....	1,583,400	706,400	656,100	260,000	173,000
1897.....	1,621,300	729,100	653,500	273,500	175,000

ITALY.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules.	Asses.	Goats.
1876.....	3,480,125	6,977,104	1,533,582	657,544	293,808	498,766	1,688,478
1882.....	4,783,232	8,596,108	2,064,000	660,123	362,428	674,246	2,016,307
1890 ^a	5,000,000	6,900,000	1,800,000	720,000	300,000	1,000,000	1,800,000
1894.....	.....	.....	.....	^b 702,390	327,615	.....	.....

^a Estimated.^b Not including cavalry horses.

Number of live stock in foreign countries—Continued.

JAPAN.

Year.	Cattle.	Horses.
1888.....	1,011,261	1,529,899
1890.....	1,044,976	1,546,300
1891.....	1,057,422	1,547,647
1892.....	1,094,799	1,554,652
1893.....	1,105,201	1,561,373
1894.....	1,091,369	a 1,477,021
1895.....	1,130,278	1,530,609
1896.....	1,149,761	1,578,117
1897.....	1,214,159	1,592,871

a Not including cavalry horses.

ROUMANIA.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules and asses.	Goats.
1884.....	2,376,056	4,654,776	886,441	532,881	2,482	244,925
1888.....	2,406,017	4,973,280	796,907	563,744	6,044	165,235
1890.....	2,520,380	5,002,390	920,124	594,962	6,460	209,900

RUSSIA IN EUROPE. a

Year.	Cattle.	Sheep.	Hogs.	Horses.	Goats.
1870.....	21,408,800	45,296,700	9,050,800	15,611,400	1,180,400
1877.....	27,323,219	51,822,238	10,839,093	17,589,118	1,547,587
1883.....	23,628,031	46,724,736	9,361,980	17,880,792	1,067,137
1888.....	24,609,264	44,465,454	9,242,997	19,663,336	.....

a Not including Poland.

POLAND.

Year.	Cattle.	Sheep.	Hogs.	Horses.
1888.....	3,013,392	3,754,665	1,499,077	1,294,342

SWEDEN.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Goats.
1880.....	2,227,757	1,457,462	419,197	464,820	107,663
1890.....	2,399,491	1,350,804	644,861	487,429	86,980
1893.....	2,473,981	1,323,978	717,339	495,443	77,984
1895.....	2,540,225	1,313,385	787,461	506,026	74,327
1897.....	2,548,192	1,296,851	802,859	516,809	76,564

NORWAY.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Goats.	Reindeer.
1835.....	644,414	1,028,945	79,874	113,163	184,518	82,225
1845.....	842,568	1,447,274	88,637	131,894	290,952	90,273
1855.....	949,935	1,596,199	113,320	154,447	357,162	116,891
1865.....	953,036	1,705,394	96,166	149,167	290,985	101,768
1875.....	1,016,617	1,680,306	101,020	151,903	322,861	96,567
1890.....	1,006,499	1,417,524	121,657	150,898	272,458	173,134

Number of live stock in foreign countries—Continued.

ALGERIA.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules.	Asses.	Camels.	Goats.
1891.....	1,233,051	8,869,671	81,106	212,774	145,228	294,925	259,094	3,709,600
1892.....	1,193,915	9,502,046	86,010	213,917	146,108	290,846	268,078	3,829,740
1893.....	1,133,599	7,695,789	83,700	208,537	139,395	274,968	246,030	3,368,125
1894.....	1,121,246	7,891,979	84,068	216,636	142,021	286,803	255,408	3,545,041
1895.....	1,104,160	7,435,206	83,761	213,376	145,105	277,408	238,101	3,361,873

ARGENTINA.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules and asses.	Goats.	Fowls, all kinds. ^a
1888.....	21,931,657	66,706,097	393,758	4,234,032	417,494	1,894,386	5,299,877
1895.....	21,701,526	74,379,562	652,766	4,446,859	483,369	2,748,860	9,111,322

^a Not including 176,125 ostriches.

URUGUAY.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules.	Goats.
1892.....	5,487,604	11,012,769	20,218	389,180	11,026	3,306
1893.....	5,496,975	12,249,787	27,732	398,475	10,643	4,661
1894.....	5,205,272	12,820,736	26,215	378,960	11,302	3,603
1895.....	5,247,871	14,333,626	30,751	388,348	14,087	4,029
1896.....	5,881,402	16,397,484	32,494	392,246	15,589	4,311
1897.....	4,958,772	14,447,714	29,829	358,067	13,144	3,374

SERVIA.

Year.	Cattle.	Buffaloes.	Sheep.	Hogs.	Horses.	Mules and asses.	Goats.
1890.....	819,251	8,494	2,963,904	908,603	163,391	1,575	509,738
1895.....	915,428	7,471	3,094,206	904,446	169,928	1,778	525,991

SPAIN.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules.	Asses.	Goats.
1891.....	2,217,659	13,359,473	1,927,864	397,172	767,928	753,914	2,534,219

SWITZERLAND.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules.	Asses.	Goats.
1876.....	1,035,856	367,549	334,507	100,933	3,145	2,113	396,001
1886.....	1,212,538	341,804	394,917	98,622	2,742	2,046	416,323
1896.....	1,306,696	271,901	566,974	108,969	3,125	1,740	415,817

BULGARIA.

Year.	Cattle.	Sheep.	Hogs.	Horses.	Mules.	Asses.	Goats.
1893.....	1,767,974	6,868,291	461,635	343,946	8,264	81,610	1,263,772

^a Including 342,193 buffaloes.

SOME AGRICULTURAL EXPERIMENT STATION WORK.

Abstracted by GEORGE FAYETTE THOMPSON,

Editorial Clerk, Bureau of Animal Industry.

FEED AND CARE OF THE DAIRY COW.

[H. M. COTTRELL, M. S., F. C. BURTIS, M. S., and D. H. OTIS, M. S., Bulletin No. 81, Kansas Experiment Station.]

Fall calving is advocated for several reasons. The greatest yield of butter fat is from cows that calve in the fall if proper feed and care are given during the winter, and the prices of butter fat are higher during the winter season. By way of illustration it is stated that "a cow owned by the college gave the following yields of butter fat in pounds, by months, for ten months: 21.3, 31.9, 31.2, 30.5, 32.9, 29, 28.7, 28.8, 26.2, and 22.2. If this product had been sold to one of the leading Kansas creameries at the prices paid last year, and the cow had calved April 1, the returns would have been \$44.80, while if she had calved September 1, the same product would have brought \$49.44, a difference of \$4.64 for a single cow." A cow that calves in the fall is in best condition to increase her flow when grass comes in the spring. Cows with fair surroundings are more comfortable in winter than in summer, when heat, flies, and drought may be severe. Winter dairying gives employment to the farmer when other farm operations are practically at a standstill. In the winter, too, calves can have more careful raising. Heat, flies, diarrhea, and sour milk are thus avoided at weaning time, and the calf can go from milk to green pasture without check of growth.

Space is well given to treatment of the cow before calving, at calving time, and after calving, and the best conditions for milk production are considered. The best conditions for yield of milk in Kansas are in early June, when the cow has appetizing, succulent food, rich in milk-making materials. The composition of the cow's feed receives attention, and the statement is made that "the weakest point in Kansas dairying is in the composition of the ration given, the average ration being greatly deficient in protein and having too much carbohydrates and fat."

Protein includes those materials which contain nitrogen. It enters into the composition of milk, blood, muscle, hair, and the brain and nerves, and is absolutely indispensable in the formation of all of these, and no other substance can take its place. It may also furnish heat and energy to the body, and be transformed into fat.

Carbohydrates include the fiber of feeds, the sugars, starch, gums, and similar substances. They furnish heat, energy, and fat to the body.

Fat includes all fatty substances found in feeds. The fats in the food produce heat, energy, and fat in the body. One pound of fat is worth 2.2 pounds of protein or carbohydrates for heat production.

It has been shown by investigation that a fair milk ration for a "1,000-pound cow should contain about 2.5 pounds of digestible protein, 12.5 pounds of digestible carbohydrates, and 0.4 pound of digestible fat."

Protein is essential to the production of milk and blood and of all other substances in the body containing nitrogen, and no other material can take its place or be changed into it. On the other hand, if protein is in excess in the feed, it can be used by the animal for supplying heat and energy, and may become a source of fat, taking the place of the carbohydrates and fat. For this reason, the amount of protein in the ration may be increased above the amount, 2.5 pounds, called for by the standard ration, and the amount of carbohydrates and fat correspondingly decreased, as the protein will take their place. Carbohydrates and fat can not take the place of protein, and no matter in how large quantities they may be fed, if the protein is deficient the milk yield will be cut down.

"A cow can have too much protein, and a few dairymen in this State are feeding too much. The mistake is usually made by farmers who have fed timothy or prairie hays or corn fodder and have found that with these feeds they have had to use bran and linseed or cotton-seed meal to get a satisfactory milk yield. Many such farmers, when feeding alfalfa hay, continue to use the same grain rations as before. This gives an overfeed of protein, injures the cow, and is a waste of feed. Alfalfa, properly cured, has too great a proportion of protein to carbohydrates, and should be given with grain feeds rich in carbohydrates, such as corn, kafir corn, or corn-and-cob meal. It should not be fed with grain feeds rich in protein, such as linseed, cotton-seed, gluten, or soy bean meals or bran, unless roughness rich in carbohydrates is also fed."

This bulletin gives 100 rations, calculated for a cow in full flow of milk. These rations are given herewith:

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds.

No. of ration.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohydrates.	Fat.
		Pounds.	Pounds.	Pounds.	Pnds.
1	Alfalfa	25	10.6	37.3	1.4
	Corn fodder (or sorghum 7, or millet 6)	9	2	33.2	.6
2	Alfalfa	25	10.6	37.3	1.4
	Corn fodder	5	2	33.2	.6
	Kafir corn	2	7.8	57.1	2.7

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds
Continued.

No. of ration.	Kind of feed.	Weight of food.	Digestible nutrients 100 pounds		
			Protein.	Carbohydrates.	F.
		Pounds.	Pounds.	Pounds.	P.
3	Alfalfa	25	10.6	37.3	
	Corn (or Kafir corn 4)	3.5	7.8	66.7	
4	Alfalfa	20	10.6	37.3	
	Corn (or Kafir corn 8)	7	7.8	66.7	
5	Alfalfa	20	10.6	37.3	
	Corn (or Kafir corn 7)	6	7.8	66.7	
6	Oats	2	9.3	48.3	
	Alfalfa	20	10.6	37.3	
7	Corn	4	7.8	66.7	
	Kafir corn	4	7.8	57.1	
8	Alfalfa	20	10.6	37.3	
	Fodder corn	15	2.5	33.4	
9	Alfalfa	20	10.6	37.3	
	Corn fodder	8	2	33.2	
10	Corn	4	7.8	66.7	
	Alfalfa	20	10.6	37.3	
11	Millet	5	4.5	51.7	
	Corn	4	7.8	66.7	
12	Alfalfa	20	10.6	37.3	
	Sorghum hay	8	2.4	40.6	
13	Corn	3	7.8	66.7	
	Alfalfa	20	10.6	37.3	
14	Prairie hay	5	3.5	41.8	
	Kafir corn	5	7.8	57.1	
15	Alfalfa	20	10.6	37.3	
	Mangels	20	1	5.7	
16	Corn	5.5	7.8	66.7	
	Alfalfa	20	10.6	37.3	
17	Corn ensilage	15	1.3	14	
	Kafir corn	5	7.8	57.1	
18	Alfalfa	15	10.6	37.3	
	Corn fodder	10	2	33.2	
19	Corn	5	7.8	66.7	
	Soy bean meal	1.5	29.6	22.3	
20	Alfalfa	15	10.6	37.3	
	Millet	5	4.5	51.7	
21	Kafir corn	7	7.8	57.1	
	Soy bean meal	1	29.6	22.3	
22	Alfalfa	15	10.6	37.3	
	Sorghum hay	4	2.4	40.6	
23	Kafir corn	8	7.8	57.1	
	Soy bean meal	1	29.6	22.3	
24	Alfalfa	15	10.6	37.3	
	Prairie hay	5	3.5	41.8	
25	Corn	6	7.8	66.7	
	Soy-bean meal	2	29.6	22.3	
26	Alfalfa	15	10.6	37.3	
	Mangels	10	1	5.7	
27	Corn fodder	5	2	33.2	
	Corn	3	7.8	66.7	
28	Kafir corn	3	7.8	57.1	
	Bran	2	12.3	37.1	

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.

No. of ra- tion.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohy- drates.	Fat.
		Pounds.	Pounds.	Pounds.	Pnds.
19	Alfalfa	15	10.6	37.3	1.4
	Corn ensilage	20	1.3	14	.7
	Corn	4	7.8	66.7	4.3
	Bran	3	12.3	37.1	2.6
20	Alfalfa	10	10.6	37.3	1.4
	Corn fodder	15	2	33.2	.6
	Linseed meal (old process)	3	28.8	32.9	7.1
	Corn	4.5	7.8	66.7	4.3
21	Alfalfa	10	10.6	37.3	1.4
	Millet	10	4.5	51.7	1.4
	Corn	3	7.8	66.7	4.3
	Soy-bean meal	1.5	29.6	22.3	14.4
22	Bran	3	12.3	37.1	2.6
	Alfalfa	10	10.6	37.3	1.4
	Sorghum hay	10	2.4	40.6	1.2
	Corn	1.5	7.8	66.7	4.3
23	Oats	5	9.3	48.3	4.2
	Chicago gluten meal	2	31.1	43.9	4.8
	Alfalfa	10	10.6	37.3	1.4
	Prairie hay	10	3.5	41.8	1.4
24	Kafir corn (or corn 4.5)	5	7.8	57.1	2.7
	Soy-bean meal	3	29.6	22.3	14.4
	Alfalfa	10	10.6	37.3	1.4
	Mangels	10	1	5.7	.1
25	Corn fodder	15	2	33.2	.6
	Kafir corn	3	7.8	57.1	2.7
	Soy-bean meal	2	29.6	22.3	14.4
	Bran	2	12.3	37.1	2.6
26	Alfalfa	10	10.6	37.3	1.4
	Corn ensilage	30	1.3	14	.7
	Corn	5	7.8	66.7	4.3
	Soy-bean meal	3	29.6	22.3	14.4
27	Alfalfa	5	10.6	37.3	1.4
	Corn fodder	15	2	33.2	.6
	Corn	6	7.8	66.7	4.3
	Cotton-seed meal	3	37	16.5	12.6
28	Bran	1	12.3	37.1	2.6
	Alfalfa	5	10.6	37.3	1.4
	Millet	15	4.5	51.7	1.4
	Bran	5	12.3	37.1	2.6
29	Cotton-seed meal	2	37	16.5	12.6
	Alfalfa	5	10.6	37.3	1.4
	Sorghum hay	15	2.4	40.6	1.2
	Corn	4	7.8	66.7	4.3
30	Bran	2.5	12.3	37.1	2.6
	Cotton-seed meal	3	37	16.5	12.6
	Alfalfa	5	10.6	37.3	1.4
	Prairie hay	13	3.5	41.8	1.4
31	Corn	4	7.8	66.7	4.3
	Soy-bean meal	3	29.6	22.3	14.4
	Bran	3	12.3	37.1	2.6

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.

No. of ration.	Kind of feed.	Weight of food	Digestible nutrients for 100 pounds.			
			Protein.	Carbohydrates.	Fat.	
		Pounds.	Pounds.	Pounds.	Perc. 100.	
30	Alfalfa.....	5	10.6	37.3	1.4	
	Ensilage (corn).....	40	1.3	14	.7	
	Corn.....	3	7.8	66.7	4.3	
	Oats.....	3	9.3	48.3	4.2	
	Cotton-seed meal.....	1	37	16.5	12.6	
	Linseed meal (old process).....	2	28.8	32.8	7.1	
31	Corn fodder.....	26	2	33.2	.6	
	Bran.....	6	12.3	37.1	2.6	
	Soy-bean meal.....	3	29.6	22.3	14.4	
	Cotton-seed meal.....	1	37	16.5	12.6	
	Corn fodder.....	20	2	33.2	.6	
	Oats.....	4	9.3	48.3	4.2	
32	Kafir corn.....	2	7.8	57.1	2.7	
	Soy-bean meal.....	3	29.6	22.3	14.4	
	Bran.....	2.5	12.3	37.1	2.6	
	Cotton-seed meal.....	1	37	16.5	12.6	
	Corn fodder.....	20	2	33.2	.6	
	Sorghum hay.....	7	2.4	40.6	1.2	
33	Bran.....	5	12.3	37.1	2.6	
	Linseed meal (old process).....	2	28.8	32.8	7.1	
	Cotton-seed meal.....	2	37	16.5	12.6	
	Corn fodder.....	20	2	33.2	.6	
	Mangels.....	10	1	5.7	.1	
	Corn.....	4.5	7.8	66.7	4.3	
34	Cotton-seed meal.....	2	37	16.5	12.6	
	Chicago gluten meal.....	2	31.1	43.9	4.8	
	Linseed meal (old process).....	1	28.8	32.8	7.1	
	Corn fodder.....	20	2	33.2	.6	
	Ensilage (corn).....	20	1.3	14	.7	
	Bran.....	6	12.3	37.1	2.6	
35	Cotton-seed meal.....	3	37	16.5	12.6	
	Corn fodder.....	15	2	33.2	.6	
	Millet.....	10	4.5	51.7	1.4	
	Corn.....	1	7.8	66.7	4.3	
	Chicago gluten meal.....	3	31.1	43.9	4.8	
	Cotton-seed meal.....	2	37	16.5	12.6	
36	Corn fodder.....	15	2	33.2	.6	
	Sorghum hay.....	10	2.4	40.6	1.2	
	Corn-and-cob meal.....	2.5	6.5	55.3	2.9	
	Cotton-seed meal.....	4	37	16.5	12.6	
	Linseed meal (old process).....	2	28.8	32.8	7.1	
	Corn fodder.....	15	2	33.2	.6	
37	Prairie hay.....	8	3.5	41.8	1.4	
	Oats.....	1	9.3	48.3	4.2	
	Kafir corn.....	3	7.8	57.1	2.7	
	Soy-bean meal.....	3	29.6	22.3	14.4	
	Cotton-seed meal.....	2	37	16.5	12.6	
	Corn fodder.....	15	2	33.2	.6	
38	Oat straw.....	10	1.6	41.6	.7	
	Bran.....	4.5	12.3	37.1	2.6	
	Linseed meal (old process).....	3	28.8	32.8	7.1	
	Cotton-seed meal.....	2	37	16.5	12.6	
	Corn.....	1	7.8	66.7	4.3	
	Chicago gluten meal.....	3	31.1	43.9	4.8	

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.

No. of ration.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohydrates.	Fat.
		Pounds.	Pounds.	Pounds.	Pnds.
	Corn fodder.....	10	2	33.2	0.6
	Mangels.....	10	1	5.7	.1
40	Millet hay.....	7	4.5	51.7	1.4
	Corn.....	5	7.8	66.7	4.3
	Chicago gluten meal.....	3	31.1	43.9	4.8
	Cotton-seed meal.....	2	37	16.5	12.6
	Millet hay.....	20	4.5	51.7	1.4
41	Bran.....	4	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6
	Millet hay.....	20	4.5	51.7	1.4
	Bran.....	1	12.3	37.1	2.6
42	Linseed meal (old process).....	2	28.8	32.8	7.1
	Cotton-seed meal.....	3	37	16.5	12.6
	Millet hay.....	20	4.5	51.7	1.4
	Mangels.....	10	1	5.7	.1
43	Soy-bean meal.....	1	29.6	22.3	14.4
	Bran.....	1	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6
	Millet hay.....	15	4.5	51.7	1.4
	Corn ensilage.....	15	1.3	14	.7
44	Bran.....	1.5	12.3	37.1	2.6
	Chicago gluten meal.....	2	31.1	43.9	4.8
	Cotton-seed meal.....	2.5	37	16.5	12.6
	Millet hay.....	15	4.5	51.7	1.4
	Corn fodder.....	8	2	33.2	.6
45	Bran.....	1	12.3	37.1	2.6
	Linseed meal (old process).....	3	28.8	32.8	7.1
	Cotton-seed meal.....	2	37	16.5	12.6
	Millet hay.....	15	4.5	51.7	1.4
	Mangels.....	10	1	5.7	.1
46	Kafir corn.....	2.5	7.8	57.1	2.7
	Bran.....	4	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6
	Millet hay.....	10	4.5	51.7	1.4
	Fodder corn.....	10	2.5	33.4	1.2
47	Soy-bean meal.....	2	29.6	22.3	14.4
	Bran.....	5	12.3	37.1	2.6
	Cotton-seed meal.....	2	37	16.5	12.6
	Millet hay.....	10	4.5	51.7	1.4
	Corn fodder.....	10	2	33.2	.6
48	Oats.....	3	9.3	48.3	4.2
	Bran.....	4	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6
	Millet hay.....	10	4.5	51.7	1.4
	Prairie hay.....	10	3.5	41.8	1.4
49	Mangels.....	10	1	5.7	.1
	Bran.....	4	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6
	Millet hay.....	10	4.5	51.7	1.4
50	Oat straw.....	10	1.6	41.6	.7
	Bran.....	6.5	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.

No. of ration.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohydrates.	Fat.
		Pounds.	Pounds.	Pounds.	Pounds.
51	Sorghum hay.....	25	2.4	40.6	1.2
	Bran.....	1.5	12.3	37.1	2.6
	Chicago gluten meal.....	2	31.1	43.9	4.8
	Cotton-seed meal.....	3	37	16.5	12.6
52	Sorghum hay.....	20	2.4	40.6	1.2
	Corn.....	3	7.8	63.7	4.3
	Chicago gluten meal.....	3	31.1	43.9	4.8
	Cotton-seed meal.....	3	37	16.5	12.6
53	Sorghum hay.....	20	2.4	40.6	1.2
	Kafir corn.....	3	7.8	57.1	2.7
	Oats.....	1	9.3	48.3	4.2
	Soy-bean meal.....	2	29.6	22.3	14.4
54	Cotton-seed meal.....	3	37	16.5	12.6
	Sorghum hay.....	20	2.4	40.6	1.2
	Bran.....	8	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6
55	Sorghum hay.....	15	2.4	40.6	1.2
	Corn fodder.....	10	2	33.2	.6
	Soy-bean meal.....	3	29.6	22.3	14.4
	Bran.....	3	12.3	37.1	2.6
56	Cotton-seed meal.....	2	37	16.5	12.6
	Sorghum hay.....	15	2.4	40.6	1.2
	Prairie hay.....	10	3.5	41.8	1.4
	Bran.....	1.5	12.3	37.1	2.6
57	Linseed meal (old process).....	2	28.8	32.8	7.1
	Cotton-seed meal.....	2	37	16.5	12.6
	Sorghum hay.....	15	2.4	40.6	1.2
	Millet hay.....	6	4.5	51.7	1.4
58	Bran.....	6.5	12.3	37.1	2.6
	Cotton-seed meal.....	3	37	16.5	12.6
	Sorghum hay.....	15	2.4	40.6	1.2
	Mangels.....	15	1	5.7	.1
59	Corn.....	5.5	7.8	63.7	4.3
	Chicago gluten meal.....	1.5	31.1	43.9	4.8
	Cotton-seed meal.....	3	37	16.5	12.6
	Sorghum hay.....	10	2.4	40.6	1.2
60	Orchard grass.....	13	4.8	42	1.4
	Bran.....	3	12.3	37.1	2.6
	Chicago gluten meal.....	1	31.1	43.9	4.8
	Cotton-seed meal.....	3	37	16.5	12.6
61	Sorghum hay.....	10	2.4	40.6	1.2
	Oat straw.....	10	1.6	41.6	.7
	Oats.....	4	9.3	48.3	4.2
	Kafir corn.....	1	7.8	57.1	2.7
62	Soy-bean meal.....	2	29.6	22.3	14.4
	Cotton-seed meal.....	3	37	16.5	12.6
	Prairie hay.....	20	3.5	41.8	1.4
	Kafir corn.....	3	7.8	57.1	2.7
63	Bran.....	2	12.3	37.1	2.6
	Chicago gluten meal.....	2	31.1	43.9	4.8
	Cotton-seed meal.....	2	37	16.5	12.6

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.

No. of ration.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohydrates.	Fat.
		<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pnds.</i>
62	Prairie hay	20	3.5	41.8	1.4
	Chicago gluten meal	3.5	31.1	43.9	4.8
	Bran	6	12.3	37.1	2.6
63	Prairie hay	20	3.5	41.8	1.4
	Bran	8	12.3	37.1	2.6
	Cotton-seed meal	2.5	37	16.5	12.6
64	Prairie hay	20	3.5	41.8	1.4
	Corn	3	7.8	66.7	4.3
	Chicago gluten meal	1.5	31.1	43.9	4.8
	Cotton-seed meal	3	37	16.5	12.6
	Prairie hay	20	3.5	41.8	1.4
65	Oats	3.5	9.3	48.3	4.2
	Bran	4	12.3	37.1	2.6
	Linseed meal (old process)	1	28.8	32.8	7.1
	Cotton-seed meal	2	37	16.5	12.6
	Prairie hay	18	3.5	41.8	1.4
66	Mangels	20	1	5.7	.1
	Bran	6	12.3	37.1	2.6
	Cotton-seed meal	3	37	16.5	12.6
	Prairie hay	15	3.5	41.8	1.4
	Millet hay	5	4.5	51.7	1.4
67	Bran	4	12.3	37.1	2.6
	Corn	2	7.8	66.7	4.3
	Cotton-seed meal	3	37	16.5	12.6
	Prairie hay	15	3.5	41.8	1.4
	Sorghum hay	10	2.4	40.6	1.2
68	Bran	2.5	12.3	37.1	2.6
	Chicago gluten meal	1	31.1	43.9	4.8
	Cotton-seed meal	3	37	16.5	12.6
	Prairie hay	15	3.5	41.8	1.4
	Sorghum hay	7	2.4	40.6	1.2
69	Bran	6	12.3	37.1	2.6
	Cotton seed meal	3	37	16.5	12.6
	Prairie hay	10	3.5	41.8	1.4
	Fodder corn	12	2.5	33.4	1.2
	Kafir corn	4	7.8	57.1	2.7
70	Soy-bean meal	5.5	20.6	22.3	14.4
	Timothy hay	10	2.9	43.7	1.4
	Corn fodder	10	2	33.2	.6
	Corn	3	7.8	66.7	4.3
	Bran	4	12.3	37.1	2.6
71	Cotton-seed meal	3	37	16.5	12.6
	Linseed meal (old process)	1	28.8	32.8	7.1
	Timothy hay	10	2.9	43.7	1.4
	Clover	10	6.8	35.4	1.7
	Sorghum hay	5	2.4	40.6	1.2
72	Corn	2	7.8	66.7	4.3
	Bran	2	12.3	37.1	2.6
	Cotton-seed meal	3	37	16.5	12.6

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.

No. of ration.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohydrates.	Fat.
		Pounds.	Pounds.	Pounds.	Pnds.
73	Timothy hay	19	2.9	43.7	1.4
	Clover	19	6.8	35.4	1.7
	Corn	4	7.8	66.7	4.3
	Bran	2	12.3	37.1	2.6
	Linseed meal (old process)	3.5	28.8	32.8	7.1
74	Timothy hay	10	2.9	43.7	1.4
	Clover	10	6.8	35.4	1.7
	Mangels	16	1	5.7	.1
	Corn	3	12.3	37.1	2.6
	Cotton-seed meal	2.5	37	16.5	12.6
75	Timothy hay	10	2.9	43.7	1.4
	Clover	5	6.8	35.4	1.7
	Corn ensilage	15	1.3	14	.7
	Oats	4	9.3	48.3	4.2
	Corn	2.5	7.8	66.7	4.3
76	Cotton-seed meal	3	37	16.5	12.6
	Timothy hay	8	2.9	43.7	1.4
	Clover	8	6.8	35.4	1.7
	Corn fodder	8	2	33.2	.6
	Oats	2.5	9.3	48.3	4.2
77	Bran	4	12.3	37.1	2.6
	Linseed meal (old process)	3	28.8	32.8	7.1
	Timothy hay	5	2.9	43.7	1.4
	Clover	5	6.8	35.4	1.7
	Corn fodder	10	2	33.2	.6
78	Corn	3.5	7.8	66.7	4.3
	Bran	5	12.3	37.1	2.6
	Linseed meal (old process)	2	28.8	32.8	7.1
	Cotton seed meal	1	37	16.5	12.6
	Orchard grass	10	4.8	42	1.4
79	Clover	10	6.8	35.4	1.7
	Corn fodder	10	2	33.2	.6
	Chicago gluten meal	3	31.1	43.9	4.8
	Bran	1	12.3	37.1	2.6
	Linseed meal (old process) .....	.5	28.8	32.8	7.1
80	Orchard grass	10	4.8	42	1.4
	Clover	10	6.8	35.4	1.7
	Corn	3	7.8	66.7	4.3
	Bran	3	12.3	37.1	2.6
	Soy bean meal	3	29.6	22.3	14.4
81	Orchard grass	10	4.8	42	1.4
	Clover	10	6.8	35.4	1.7
	Mangels	10	1	5.7	.1
	Corn	2	7.8	66.7	4.3
	Bran	3	12.3	37.1	2.6
82	Cotton seed meal	1.5	37	16.5	12.6
	Orchard grass	10	4.8	42	1.4
	Clover	10	6.8	35.4	1.7
	Corn	4	7.8	66.7	4.3
	Chicago gluten meal	3	31.1	43.9	4.8
83	Bran	1	12.3	37.1	2.6

One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.

No. of ra- tion.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohy- drates.	Fat.
		Pounds.	Pounds.	Pounds.	Pnds.
82	Orchard grass	10	4.8	42	1.4
	Clover	5	6.8	35.4	1.7
	Prairie hay	5	3.5	41.8	1.4
	Corn	3	7.8	66.7	4.3
	Oats	2	9.3	48.3	4.2
83	Chicago gluten meal	3	31.1	43.9	4.8
	Cotton-seed meal	1	37	16.5	12.6
	Orchard grass	7	4.8	42	1.4
	Clover	7	6.8	35.4	1.7
	Corn ensilage	16	1.3	14	.7
84	Corn	4	7.8	66.7	4.3
	Cotton-seed meal	2	37	16.5	12.6
	Soy-bean meal	2	29.6	22.3	14.4
	Orchard grass	5	4.8	42	1.4
	Clover	5	6.8	35.4	1.7
85	Corn ensilage	25	1.3	14	.7
	Corn	4.5	7.8	66.7	4.3
	Bran	1.5	12.3	37.1	2.6
	Cotton-seed meal	3	37	16.5	12.6
	Orchard grass	13	4.8	42	1.4
86	Corn ensilage	20	1.3	14	.7
	Corn	3	7.8	66.7	4.3
	Cotton-seed meal	3	37	16.5	12.6
	Bran	3	12.3	37.1	2.6
	Corn ensilage	40	1.3	14	.7
87	Prairie hay (or millet 8)	10	3.5	41.8	1.4
	Bran	4.5	12.3	37.1	2.6
	Cotton-seed meal	3	37	16.5	12.6
	Ensilage	40	1.3	14	.7
	Corn fodder	10	2	33.2	.6
88	Bran	4	12.3	37.1	2.6
	Chicago gluten meal	2	31.1	43.9	4.8
	Cotton-seed meal	2	37	16.5	12.6
	Ensilage	40	1.3	14	.7
	Sorghum hay	5	2.4	40.6	1.2
89	Corn	3	7.8	66.7	4.3
	Bran	1.5	12.3	37.1	2.6
	Chicago gluten meal	3	31.1	43.9	4.8
	Cotton-seed meal	1.5	37	16.5	12.6
	Ensilage	30	1.3	14	.7
90	Millet hay	10	4.5	51.7	1.4
	Corn	4	7.8	66.7	4.3
	Chicago gluten meal	1	31.1	43.9	4.8
	Cotton-seed meal	3	37	16.5	12.6
	Ensilage	30	1.3	14	.7
91	Fodder corn	15	2.5	33.4	1.2
	Bran	2.5	12.3	37.1	2.6
	Chicago gluten meal	3	31.1	43.9	4.8
	Cotton-seed meal	1.5	37	16.5	12.6

*One hundred dairy rations, showing amount of digestible nutrients per 100 pounds—
Continued.*

No. of ra- tion.	Kind of feed.	Weight of food.	Digestible nutrients for 100 pounds.		
			Protein.	Carbohy- drates.	Fat.
		Pounds.	Pounds.	Pounds.	Pounds.
91	Ensilage	30	1.3	14	0.7
	Corn fodder	10	2	33.2	.6
	Corn	3.5	7.8	66.7	4.3
	Bran	4.5	12.3	37.1	2.6
	Cotton-seed meal	3	37	16.5	12.6
92	Ensilage	30	1.3	14	.7
	Oat straw	10	1.6	41.6	.7
	Oats	2	9.3	48.3	6.2
	Bran	4	12.3	37.1	2.6
	Chicago gluten meal	2	31.1	43.9	4.8
93	Cotton-seed meal	2	37	16.5	12.6
	Ensilage	25	1.3	14	.7
	Prairie hay	10	3.5	41.8	1.4
	Corn fodder	5	2	33.2	.6
	Corn	1	7.8	66.7	4.3
94	Chicago gluten meal	3	31.1	43.9	4.8
	Cotton-seed meal	2	37	16.5	12.6
	Ensilage	20	1.3	14	.7
	Oat straw	9	1.6	41.6	.7
	Oats	3.5	9.3	48.3	6.2
95	Bran	7	12.3	37.1	2.6
	Soy-bean meal	2	29.6	22.3	14.4
	Cotton-seed meal	1	37	16.5	12.6
	Ensilage	20	1.3	14	.7
	Alfalfa	20	10.6	37.3	1.4
96	Corn	3	7.8	66.7	4.3
	Oat straw	20	1.6	41.6	.7
	Bran	7	12.3	37.1	2.6
	Cotton-seed meal	4	37	16.5	12.6
	Oat straw	15	1.6	41.6	.7
97	Corn	6	7.8	66.7	4.3
	Chicago gluten meal	3	31.1	43.9	4.8
	Linseed meal (old process)	3	28.8	32.8	7.1
	Oat straw	15	1.6	41.6	.7
	Mangels	10	1	5.7	.1
98	Corn	5	7.8	66.7	4.3
	Chicago gluten meal	3	31.1	43.9	4.8
	Cotton seed meal	3	37	16.5	12.6
	Oat straw	10	1.6	41.6	.7
	Wheat straw	10	.8	37.9	.5
99	Mangels	8	1	5.7	.1
	Bran	6	12.3	37.1	2.6
	Chicago gluten meal	2	31.1	43.9	4.8
	Cotton-seed meal	2.5	37	16.5	12.6
	Wheat straw	18	.8	37.9	.5
100	Mangels	15	1	5.7	.1
	Corn	2	7.8	66.7	4.3
	Bran	4	12.3	37.1	2.6
	Cotton-seed meal	2	37	16.5	12.6
	Soy-bean meal	3	29.6	22.3	14.4

The value of the different kinds of feed is discussed. These are worthy a place here, and are given below:

VALUE OF DIFFERENT FEEDS.

Alfalfa is essential, under Kansas conditions, to the cheapest production of milk and butter fat. When fed in considerable quantities it can be combined with other feeds usually grown on the farm to make a good dairy ration without any purchased feeds. Good alfalfa hay contains over 86 per cent as much protein as bran, is our most palatable rough feed, keeps the cow in healthful condition, and, cut early and well cured, is eaten without waste. Fed in sufficient quantity it produces an abundant flow of milk, with butter of good character. Under favorable conditions three or more crops are harvested a year, and at least one good crop in the driest year in any part of the State. It is often hard to get alfalfa started, and if seasons are unfavorable it is sometimes necessary to reseed in order to get a good stand, but the crop is worth the cost. Alfalfa is a crop that is worth great care in harvesting. Our table of feedstuffs gives the average amount of digestible protein in alfalfa as 10.6 per cent. The amount varies from 9.9 per cent when poorly cured and roughly handled to 16.2 per cent where the greatest care has been taken in curing. As bran has only 12.8 per cent digestible protein, it can be seen that by careful handling alfalfa hay can be made which is worth more than its weight of bran. With a good stand the leaves are more than half the weight of the cured crop, and contain 85 per cent of the total yield of digestible protein. At the Colorado Experiment Station tests showed the leaves in alfalfa hay to contain 14½ per cent digestible protein, making a ton of them worth 2,400 pounds of bran. Yet alfalfa hay is frequently found which has been so roughly handled that it consists of stems only. If the dairymen who make such alfalfa hay knew that in wasting the leaves they were wasting a product worth more to them than an equal weight of bran, greater care would be taken to avoid the loss.

Corn ensilage supplies succulent feed through the winter, enabling the dairyman to get as good or better returns from his cows than in summer. When corn is put in the silo more feed can be produced from an acre than if handled in any other way. This feed is stored in good condition in small space, saved with little waste, preserved in a palatable form, eaten with small loss, and its influence is for the best on the health of the cow, her digestion, and on the quality of her products. The summer silo is one of the best means of keeping up the flow of milk during the annual failure of pasture from drought, and for this purpose alone it will pay Kansas dairymen to use ensilage and keep their cows in full flow when the price of dairy products is high. In drought, when corn is burned up too early to be saved for fodder, it can be put in the silo and will give a moderate yield of good feed when otherwise the crop would be a total loss.

Ensilage will keep as long as the silo is not opened, and has been kept in good condition for seven years. This is a special advantage to Kansas dairymen, as in years of heavy crops the surplus can be stored in silos for years of drought—making all years good crop years for silo dairymen.

Ensilage is poor in protein, and should be fed either with alfalfa or feeds like linseed, cotton-seed, gluten, and soy-bean meals. Kansas dairymen should raise alfalfa and put up corn ensilage, and with these feeds give corn, Kafir corn, or oats, or all three, and they will not need to buy feed.

Corn fodder could be improved on many farms by earlier cutting and by putting up in larger shocks. The larger the shock, the less the loss from weather. It will pay more Kansas dairymen to plant in rows the usual distance apart with stalks 8 inches apart in the row, cultivate thoroughly, put up in large shocks; and feed without husking. This makes a cheap feed. In our rations we have called corn put up in this way fodder corn, and corn planted in the usual way and husked corn fodder.

Kafir corn fodder without the heads has about the same feeding value as husked corn fodder, and one can be substituted for the other in the feeding rations we have given.

Millet should be cut early, before the seeds get firm. It is then considerably richer in protein than corn fodder, timothy, or prairie hay.

Orchard grass cut early is worth about the same as millet hay, and late is not much better than wheat straw for milk production.

Prairie hay varies greatly in quality; when early cut it ranks between corn fodder and millet. It is poor in protein and needs alfalfa or the heavy meals, as linseed and soy bean, to balance it for milk production. It tends to produce constipation, and this must be counteracted by the other feeds if good results are secured.

Timothy hay is one of the poorest milk-producing feeds used by Kansas dairymen, as well as one of the most expensive. It is low in protein, high in carbohydrates, tends to produce constipation, and requires a large amount of grain feed, rich in protein, to be given with it to produce a good milk flow. It is largely fed in eastern Kansas, but under ordinary conditions it will pay to sell timothy and buy other feed if milk is wanted.

Sorghum hay is a sure crop in all parts of the State. It is our most succulent dry feed and can be handled cheaply. Many dairymen report that when cows are fed sorghum hay they dry up rapidly, while others get good results when feeding it. A glance at the table of feed stuffs shows that sorghum hay is low in protein and high in carbohydrates. If fed with alfalfa, red clover, bran, or the meals rich in protein, it is one of our most profitable rough feeds, but when fed with other feeds low in protein, as prairie hay, corn, and Kafir corn fodder and grain, the combination makes a poor milk-producing ration, and with most cows heavy feeding will quickly stop the milk flow.

Red clover hay is next in value to alfalfa, but contains much less protein. When it is impossible to raise alfalfa, red clover should be grown, as it contains from two to three times the protein found in most farm forage except alfalfa.

Mangels, or mangel-wurzels, is the best root crop for the Kansas dairyman to raise, and if he does not have ensilage he should raise sufficient mangels to furnish 10 to 20 pounds per day to each cow through the feeding season. The best yields can not be secured in winter without succulent feed, and ensilage or mangels are the succulent feeds most practicable for Kansas dairymen. Sugar beets are worth more per ton than mangels, but do not yield as well. Plant the Long Red for feeding before New Year's and the Golden Tankard to feed from that date until the cows are turned to grass.

Bran is a standard dairy feed and is one of the best feeds to use with linseed, cotton-seed, gluten, and soy-bean meals.

Corn is poor in protein and rich in carbohydrates and is one of the best grains to feed with alfalfa. Experiments at this station have shown that corn-and-cob meal is worth as much as an equal weight of corn meal, provided it is finely ground. Coarsely ground, the cobs irritate the digestive organs of the cow, producing scouring, and the milk yield is lowered.

Kafir corn grain has the same properties as corn, but is not quite equal to it in feeding value, 7 pounds of corn having about the same feed value as 8 pounds of Kafir corn.

Oats are one of the most healthful and palatable feeds, but are usually too expensive to be fed, except in small quantities.

Cotton-seed meal is the richest in protein of any feed in reach of the Kansas dairyman. It is a powerful milk-stimulating feed, hardens the butter, and tends to produce constipation. The price varies a great deal, and it is often the cheapest source of protein. We do not feed over 4 pounds per day to a cow, and prefer not to feed more than 3, and like to mix it with linseed or soy-bean meals. When

these rich meals are fed alone or in mixtures it is well to dilute with bran. It should not be fed to cows heavy with calf nor within three weeks after calving.

Linseed meal is rich in protein, is a healthful feed, and can be safely fed at any time, and is especially valuable just before and after calving. Do not feed over 4 pounds daily and usually not more than 3. It softens the butter and should be given with some feed that has an opposite tendency. The old process is generally used in Kansas.

Soy-bean meal has about the same composition as linseed meal, and so far as tested has the same effect on milk production and quality of butter. The soy bean is one of the best drought-resisting plants, and farmers can raise it and not have to buy linseed or cotton-seed meals.

Gluten meal stands next to cotton seed in amount of protein and can often be purchased for much less. It is one of the best milk-producing feeds, causes soft butter, and must be fed with something that will harden the butter. This meal deserves more attention from Kansas dairymen who have to buy grain.

CORN MEAL AND SHORTS AS FOOD FOR PIGS.

[C. S. PLUMB, B. S., and W. B. ANDERSON, B. S.; Bulletin No. 71, Indiana Experiment Station.]

This article compares the results of feeding for seventy days a mixture of corn meal and wheat shorts to one lot of pigs and corn meal alone to another lot. Six Chester-White sow pigs, 5½ months old at the beginning of the experiment, were used. Each lot was kept in a pen about 15 by 30 feet, with a comfortable shelter house. The pigs were weighed every seven days. At the beginning those in Lot I weighed, respectively, 139.25, 115, and 133.25 pounds—a total of 387.5; those in Lot II weighed, respectively, 117.25, 145.25, and 123.25 pounds—a total of 385.75. The difference between the total weights is thus seen to be 1.75 pounds. The weights of the pigs at the end of each seven-day period is shown in the accompanying table, also the total weights, the average daily gain for each pig, and the average daily gain per head per lot.

Table showing weights of pigs at end of seven-day periods and average daily gain.

Date (1897-1898).	Lot I—Shorts-corn meal.				Lot II—Corn meal.			
	No. 138.	No. 142.	No. 143.	Total.	No. 139.	No. 166.	No. 168.	Total.
December 25	139.25	115	133.25	387.5	117.25	145.25	123.25	385.75
January 1	152	127.5	149.5	429	126	163	134	423
January 8	167.5	136.5	164.5	468.5	136.5	179	149.5	465
January 15	178	150	180	508	150	190	158.5	498.5
January 22	191	160	198	549	151.5	200.5	166	518
January 29	201	164	201.5	566.5	157.5	209	177	543.5
February 5	209	180	216.5	605.5	166	221	185.5	572.5
February 12	223	192	227	642	177.5	240	198	615.5
February 19	233	200	237	670	188.5	251	207.5	647
February 26	241.5	213.5	249	704	195	260.5	216.5	672
March 5	253	223.5	264.5	741	203.5	279	230	712.5
Total gain in weight	113.75	108.5	131.25	353.5	85.25	133.75	106.75	325.75
Average daily gain	1.62	1.55	1.87	5.05	1.21	1.91	1.52	4.66
Average daily gain per head per lot				1.68				1.55

These figures show that Lot I made a total gain in the seventy days of 353.5 pounds, while Lot II gained 326.75 pounds, a difference of 26.75 pounds in favor of Lot I. The figures also show that Lot I made a combined daily growth of 5.05 pounds, or an average of 1.68 pounds per pig, while Lot II made 4.66 pounds, or an average of 1.55 pounds per pig. The authors state that "from the practical feeder's standpoint these pigs made uncommonly good gains. Where five or six animals of this class average in daily gains for seventy days from 1½ to nearly 2 pounds each it may be considered a very satisfactory showing."

The foods given were a mixture of equal parts, by weight, of wheat shorts and corn meal for Lot I and corn meal only for Lot II. Both feeds were mixed in warm water and were given at 7 o'clock in the morning and 5 o'clock in the afternoon. The table herewith shows the food eaten during each period of seven days and also the total amount eaten by both lots. The authors assume that each of the pigs in each lot ate her third, but frankly state that this assumption can not be quite accurate.

Table showing amount of each kind of food eaten, and also the total amount, with averages.

Date (1897-1898).	Lot I—Shorts-corn meal.			Lot II— Corn meal
	Shorts.	Corn meal.	Total grain.	Corn meal.
December 25-January 1.....	62	62	124	124
January 1-8.....	68.5	68.5	137	137
January 8-15.....	73.5	73.5	147	140
January 15-22.....	73.5	73.5	147	131
January 22-29.....	71.5	71.5	143	141
January 29-February 5.....	71.5	71.5	143	145
February 5-12.....	73.5	73.5	147	147
February 12-19.....	73.5	73.5	147	147
February 19-26.....	73.5	73.5	147	147
February 26-March 5.....	77	77	154	154
Total.....	718	718	1,436	1,413
Average amount eaten per day per lot.....	10.25	10.25	20.51	20.18
Average amount eaten per day per pig.....	3.41	3.41	6.82	6.73

Lot I ate 718 pounds of shorts and 718 pounds of corn meal, a total weight of 1,436 pounds; Lot II consumed 1,413 pounds of corn meal. It is noted that the pigs of Lot II did not always eat with as good appetite as did those of the other lot.

The cost of production is the feature first considered by the practical feeder. The cost of food in this experiment is based on Lafayette prices. Accordingly the following statements are made:

Lot I:	
718 pounds shorts, at 70 cents per cwt.....	\$5.03
718 pounds corn meal, at 65 cents per cwt.....	4.67
Total value of food eaten.....	9.70
Lot II: 1,413 pounds corn meal, at 65 cents per cwt.....	9.18

The food for Lot I, therefore, cost 52 cents more than that for Lot II. Further data are as follows:

Lot I:

Cost of food	\$9.70
Pounds of gain made	353.5
Cost of food for each pound of gain	\$0.0274
Cost of each 100 pounds gain	\$2.74

Lot II:

Cost of food	\$9.18
Pounds of gain made	326.75
Cost of food for each pound of gain	\$0.028
Cost of each 100 pounds gain	\$2.80

A further study of the experiment shows that 4.06 pounds of short and corn meal mixed produced 1 pound of gain, and that 100 pounds produced 24.6 pounds of pork; also, that 4.32 pounds of corn meal alone produced 1 pound of gain, and that 100 pounds produced 23.1 pounds of pork.

Additional observations upon these sows give no substantial evidence that periods of heat, or œstrum, materially affects gain in weight.

EXPERIMENTS IN PIG FEEDING IN NEW HAMPSHIRE.

[By CHARLES M. BURKETT, M. S., Bulletin No. 60, New Hampshire Experiment Station.]

Dairying is one of the leading industries of New Hampshire, and the skim milk is almost wholly utilized as food for pigs; thus hog raising becomes a necessary adjunct to dairying in that State.

Three experiments were conducted in order to ascertain the value of different kinds of feed in connection with skim milk, as follows: (1) Pumpkins, cooked and uncooked; (2) bran, fermented and unfermented; bran and meal; corn meal; (3) corn-and-cob meal; corn on ear. The pigs employed were a cross between Chester-White sows and a Berkshire boar. Previous to the beginning of the experiment they were fed a ration consisting of skim milk, corn, and middlings. The cost of the feed used in these experiments was as follows: Pumpkins were produced at a cost of 40 cents per ton; skim milk was estimated to cost 20 cents per 100 pounds, and apples at 10 cents per bushel; corn meal cost \$16 per ton; bran, \$17 per ton.

Experiment I.—In the first experiment 18 pigs were employed—six lots of 3 each—which averaged in weight about 140 pounds, and the duration of the experiment was twenty-five days. The first table gives the live weight at beginning and ending of the experiment, the total gain, and average daily gain.

Total weights, total gains, and average daily gain of pigs fed milk, corn meal, and pumpkins.

Lot and kind of feed.	Weight at begin- ning.	Weight at end- ing.	Gain.	Average daily gain.
	Pounds.	Pounds.	Pounds.	Pounds.
Lot A:				
Milk	416	582	166	2.21
Corn meal				
Pumpkins (cooked)				
Lot B:				
Milk	426	596	170	2.26
Corn meal				
Pumpkins (uncooked)				
Lot C:				
Milk	423	507	84	1.12
Pumpkins (uncooked)				
Lot D:				
Milk	418	566	148	1.67
Corn meal				
Lot E:				
Milk	420	536	116	1.54
Pumpkins				
Apples				
Lot F:				
Milk	424	590	166	2.16
Corn meal				
Bran				

The feeding value of the rations is better shown in the second table, given herewith:

Feeding value of rations fed in Experiment I.

[illegible]

Financial summary of Experiment I.

Lot and kind of feed.	Amount of feed eaten.	Cost of food.	Market value of gain at 5½ cents per pound.	Profit.	Cost per pound gain.
Lot A:	<i>Pounds.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Milk	630	5.52	9.13	3.61	0.0332
Corn meal	514				
Cooked pumpkins	742				
Lot B:					
Milk	630	5.64	9.35	3.71	.0331
Corn meal	514				
Raw pumpkins	1,348				
Lot C:					
Milk	630	2.01	4.62	2.62	.0290
Raw pumpkins	3,798				
Lot D:					
Milk	630	5.65	8.14	2.49	.0381
Corn meal	540				
Lot E:					
Milk	630	5.30	6.38	.99	.0484
Pumpkins	1,881				
Apples	1,881				
Lot F:					
Milk	630	6.51	8.91	2.40	.0401
Corn meal	318				
Bran	318				

Mr. Burkett makes the following observation upon this work:

1. The cooking of pumpkins does not increase their feeding value.
2. When pumpkins are available for pig feeding, they can be fed most economically in connection with corn meal.
3. While raw pumpkins fed in connection with milk produced a pound of gain at small cost, so few pounds were produced it is advisable to feed corn meal with them.
4. Apples, even at the low price of 10 cents per bushel, are not an economical food for pigs.
5. Bran is not desirable as a food for pigs, even if fed with corn meal. This is further considered in the following experiment.

Experiment II.—This was conducted with four lots of pigs, three in each lot, and at the beginning of the experiment weighed from 45 to 50 pounds each. The work covered two periods—the one of ninety-nine days and the other twenty-one days. The object was to ascertain the feeding value of fermented bran, as it was thus fed quite frequently in the State by farmers who claimed good gains. The details are shown in the table following:

Total weights and gains of pigs fed fermented and unfermented bran.

Lot and ration.	Weight at begin- ning.	Weight at end.	Gain.	Days.	Daily gain.	Average daily gain.
FIRST PERIOD (99 DAYS).	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Number.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Lot A, fermented bran.....	141	321	181	99	1.83	0.61
Lot B, unfermented bran.....	144	352	208	99	2.10	.70
Lot C, bran and corn meal.....	143	370	227	99	2.29	.76
Lot D, corn meal.....	141	464	323	99	3.24	1.08
SECOND PERIOD (21 DAYS).						
Lot A, corn meal.....	321	412	91	21	4.33	1.44
Lot B, corn meal.....	352	430	78	21	3.71	1.21
Lot C, corn meal.....	370	426	56	21	2.66	.8
Lot D, corn meal.....	464	551	87	21	4.14	1.36

The fermented bran was steamed and left for ten days before using. This ration gave the least average daily gain, being 0.61 pound; unfermented bran gave 0.70 pound daily gain; bran and corn meal, 1.08 pounds. At the end of ninety-nine days the pigs were put on a ration of corn meal. The table above shows that the lot which had made such poor progress on fermented bran made the best progress on corn meal. The data for the two periods were combined, and the following summary shows the results:

Financial summary of Experiment II.

Lot and kind of feed.	Total gain.	Total cost of feed.	Cost per pound of gain for whole period.	Market value of gain at 5½c.	Profit.
Lot A:	<i>Pounds.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
First 99 days, fermented bran.....	272	10.35	0.0380	14.96	4.61
Following 21 days, corn meal.....					
Lot B:					
First 99 days, unfermented bran.....	286	11.52	.0332	15.73	4.21
Following 21 days, corn meal.....					
Lot C:					
First 99 days, bran and corn meal, equal parts.....	283	9.70	.0343	15.57	4.57
Following 21 days, corn meal.....					
Lot D:					
Whole period of 120 days, corn meal...	410	13.61	.0332	22.55	8.94

The experimenter concludes: "(1) There is but little gained in fermenting bran for pig feeding; (2) bran is undesirable as a feeding stuff for pigs, fed either alone or in combination with corn meal."

Experiment III.—Millers in New Hampshire charge 8 cents a bushel for grinding corn for pig feed. This cost, added to that of hauling it to and from the mill, becomes a question of considerable importance. Six hogs, weighing about 50 pounds each, were divided into two lots. Lot A was fed with ear corn; Lot B was fed corn-and-cob

meal. As in the previous experiments, milk in equal quantities was fed to both lots. The following table gives the total weights at beginning and end of the experiment, the gain, and the duration of the test:

Weight and gain of pigs fed ear corn and corn-and-cob meal.

Lot and feed.	Weight at be- ginning.	Weight at end.	Gain.	Days.	Average daily gain.
	Pounds.	Pounds.	Pounds.	No.	Pounds.
Lot A, corn on ear	152	220	68	28	0.81
Lot B, ground corn and cob	148	219	71	28	.87

The lot fed ear corn required 892 pounds of milk and 333 pounds of grain to make 100 pounds of gain, while the lot that was fed ground corn and cob required 855 pounds of milk and 319 pounds of grain to produce 100 pounds of gain. This is a difference of 14 pounds of corn, including the cob, having a value of 11.2 cents. "The 14 pounds gained by grinding has therefore a less feeding value than the amount paid for grinding, and we have saved at the same time the expense and labor of hauling to and from the mill." The conclusions are as follows: (1) Ground corn and cob has a slightly better feeding value than corn on the ear; (2) for practical purposes it is more economical to feed corn on the ear than to haul it to mill to be ground for feed.

VACCINATION AGAINST BLACKLEG IN UTAH.

[By LEWIS A. MERRILL, B. S., Annual Report for fiscal year of 1899, Utah Experiment Station.]

Mr. Merrill states that no disease of cattle in Utah is so familiar to the stock owners as blackleg, as it has been prevalent for twenty years at least. In Cache County it became so disastrous that cattle raising ceased to be profitable and was abandoned. The station procured a supply of the vaccine which is manufactured by the Bureau of Animal Industry, and Mr. Merrill proceeded to Utah and Cache counties and vaccinated 803 calves, belonging to thirty-one stock owners. This work was done during the four months February to May. In July a list of questions bearing on the results of the work was sent to the cattle owners and a reply was received from everyone of them.

A summary of the reports showed that only 5 calves of the 803 vaccinated died. Four of these died from the effects of castration at the same time of vaccination, an operation which was contrary to advice; they were in a herd of 48, which was vaccinated and which belonged to a man who failed to receive the warning. The fifth calf was affected with the disease when it was vaccinated.

The returns from these thirty-one cattle raisers also show that in

previous years the loss from blackleg ranged, in the counties mentioned, from 3 to 60 per cent.

Mr. Merrill says:

When we consider that vaccination was performed in different localities at different dates, on farms where the disease actually existed and on grounds which had furnished the germ and caused death, we may safely conclude that in vaccination we have a sure preventive for blackleg.

It is stated in this report that many cattle owners who saw the operation performed purchased vaccinating outfits and operated upon their own cattle. The results of this work, however, do not appear in his report.

CEREBRO-SPINAL MENINGITIS IN HORSES.

[A. T. NEALE, M. A., Ph. D., Bulletin No. 43, Delaware Experiment Station.]

The information is published that cerebro-spinal meningitis has been one of the diseases dreaded by the horse men of the Atlantic coast for fifty years. Dr. Neale states that it has also "collected heavy tribute from sheep owners." It is currently believed that it is one of the "filth diseases" and most likely to find its victims among poorly nourished colts. The facts are, however, that old and well-fed horses and mules which have been housed in new and clean stables have been stricken by it. In such cases, an attempt at explanation is made in the statement that the animals had access to decaying food. The Delaware Station made numerous attempts to demonstrate that this is the correct explanation, but have been unsuccessful.

Young horses have been isolated and fed during long intervals, without results, upon oats damaged in the shock by rainfall or badly decomposed ensilage, or poorly cured clover hay, or musty bran and wormy corn, on moldy fodder, and on normal and fermented meal from wheat cockle. In every case, these foods (the cockle meal alone excepted) have been secured in barns which at the time sheltered horses dying with so-called meningitis. Suspicion has been directed toward certain fungi, particularly to the bunt in wheat (*Tilletia caries*) and to certain aspergilli. These have been used in the foods and by injection directly into the circulatory system of horses, without results. Finally, the blood of a dying horse has been transfused into the jugular vein of a strong and vigorous colt without causing in it the slightest visible disturbance in health.

Two outbreaks of the disease occurred, one in November, 1897, and the other in April, 1898, and 7 horses died. Not one horse in either stable escaped with his life. One stable was new, while the other was old, out of repair, and not clean. Brewers' grains were kept in both barns as food for the cows, some of which was fed to the horses. One owner insisted that the grain contained poison. An examination of a sample by Professor Chester, of Pennsylvania, showed it to be swarming with bacilli closely allied to *Proteus vulgaris*. Fresh brewers' grains were obtained by the station and fed daily in large quantities during December, January, February, and March to a

young horse "without inducing disturbances of health of any kind." In another test a young horse was placed in an unclean stable where the horses which occupied it before died and was given food above suspicion. After ten days he was put in a clean stable for three weeks. "No results followed; the horse remained in health." During the next four weeks it was fed on corn and hay which was said to be the sole nourishment of the seven horses which died. "This test also gave negative results."

However, Dr. Neale says: "Such decayed grains are recognized by practitioners as a direct source of meningitis." Dr. Michner, of Doylestown, Pa., in his paper read March 3, 1891, before the Veterinary Medical Society, states in effect as follows:

Eight years ago two carloads of spoiled grain were sold at Hatfield and Doylestown stations. Forty-two deaths from meningitis among horses came under my personal notice within the following week, all of which were in barns where these grains were used, and not one single case of this disease occurred during this time in barns where these grains were not used.

Further investigation will be made by the Delaware Station.

RELATION OF WATER SUPPLY TO ANIMAL DISEASES.

[A. W. BITTING, D. V. M., Bulletin No. 70, Indiana Experiment Station.]

Water is not strictly a food, but it is essential to maintenance of animal life. A relationship may exist between water supply and disease in two ways—by an inadequate supply and by being the carrier of matter which may cause disease.

Dr. Bitting's investigations show that a horse requires 64 to 80 pounds, or 8 or 10 gallons, per day. During the months of February and March, 5 horses drank from 48 to 60 pounds per head when not at work, and from 62 to 84 pounds when at work. Forty-four per cent was drunk in the forenoon and 56 per cent in the afternoon. Cattle drink more than horses. During the same months "dry" cows drank 78 pounds and cows in full flow of milk drank 112 pounds per day. The cattle drank 72 per cent of water in the morning and 28 per cent in the evening. Similar experiments were made with hogs.

This bulletin states that the diseases which are due to an insufficient supply of water are sporadic in character—that is, they affect only an occasional animal or only a few in a herd.

Probably the most serious disease having such cause is mad itch in cattle. This occurs especially in the fall of the year, when the cattle are upon dry pasture, or when turned in upon a dry-stalk field. It may occur at other times, and also be due to other causes, but without doubt 90 per cent of the cases occurring in this State are directly traceable to this cause. Sheep also suffer from impaction and constipation, and large numbers die for want of proper water supply. Hogs, especially young ones, often succumb from like treatment. Horses probably

suffer least loss because they receive the greatest care in this respect, but no doubt many cases of colic, impaction, and constipation are traceable to this source.

However, the losses from an insufficient water supply are very small when compared with the losses which are due to water of improper character. If the source of water supply is a deep well properly protected, organisms which cause diseases will not be present; but if the source is small ponds, ditches, or streams, they may exist. While it is true that not all surface waters are dangerous, it must not be forgotten that they are constantly exposed to infection and may become dangerous at any time.

The earth serves the purpose of a filter against all germs that come upon it, very few of which will pass beyond a depth of 1 inch. The depth to which the germs penetrate the earth and the number of them have been shown by frequent tests in the veterinary laboratory of the station. The tables quoted below give interesting data. The quantity of water taken was 1 cubic centimeter (about half a common thimbleful):

Source of water.	Number of germs per cubic centimeter
Very filthy hog wallow	2,680
Ordinary hog wallow	75
Wabash River above Lafayette	1
Wabash River below Lafayette	11
Clean-looking pond	23
Filthy watering trough	24
Stock troughs	
Tile drains	
Six cisterns, without filters	
Four cisterns, with filters	
Dug well receiving surface drainage	42
Dug well 14 feet deep in corner of unprotected barn lot	29
Eight tubular wells 60 to 150 feet deep	

A test upon the filtering properties of the soil is as follows:

Depth in inches.	Number of germs.	Number of germs after a heavy rain.	Depth in inches.	Number of germs.	Number of germs after heavy rain.
Surface	518,400	312,000	12	5,200	15
1	51,200		18	10,400	
2	28,800		24	2,000	6
3	17,600		30	3,600	
4	17,600		36	4,000	4
5	13,600		42	3,600	
6	13,200	47,500	48	3,000	3
8	8,000		54	2,800	
10	12,800				

While the bacteria ordinarily found in water are not injurious, a large number indicates that it is easy for contamination to occur, thus rendering the water unwholesome.

Dr. Bitting points out that of the different diseases of live stock in Indiana hog cholera causes the greatest loss, and he says also that a careful analysis of the statistics from each township of the State shows that the streams are an important factor in its distribution. His results are given below:

In 1895, 60 townships bordering upon the Wabash, from Cass County to its mouth, show a loss of 15 per cent of the entire product, and 47 townships in the second tier show a loss of 10 per cent. In 1896 the bordering townships show a loss of 29.4 per cent, the second tier 20.5 per cent, and the third tier 16 per cent. In 1895, 44 townships bordering upon the North Fork of the White River lost 13.8 per cent, and 42 townships in the second tier 6.5 per cent. In 1896 the loss in the first tier of townships was 23.1 per cent, in the second tier 15.6 per cent, and in the third tier 7.5 per cent. In 1896, 44 townships bordering upon the South Fork of the White River lost 20 per cent of the hogs, 58 townships in the second tier lost 15 per cent, and 42 townships in the third tier lost 10.9 per cent. In 1897 the first tier of townships lost 32.1 per cent, the second tier 18.2 per cent, and the third tier 14.5 per cent. In other words, the losses in the bordering tier of townships is from 33 to 112 per cent greater than in the second tier and from 83 to 208 per cent greater than in the third tier. In each case the differences in the per cent of loss in the different tiers is much less in the third year, as in that time the disease had become generally distributed. The statistics from 1882 to 1897 show the annual loss to be greatest along the rivers.

The point is well taken that if the larger streams have such a marked influence upon the percentage of loss of hogs, it is reasonable to suppose that the smaller streams and ponds have a like effect. The first step toward the prevention of hog cholera is to supply wholesome water. These figures simply confirm the statement made by Drs. Salmon and Smith, of the Bureau of Animal Industry, in their report upon hog cholera in 1889 (p. 124).

All animals are to some extent subject to parasitic diseases, and the intestinal tract, owing to its relation to the food and water consumed, becomes the favorite point of attack. Water plays a more important part as a carrier of parasites than does food. Besides hog cholera, other diseases, the spread of which is due largely to impure water, are the twisted stomach worm of sheep (*Strongylus contortus*), nodular disease of sheep, paper skin, liver fluke, and lung worm of sheep, and worms in hogs, horses, and cattle. "Pure water from deep wells is the prevention."

FEEDING FLAVOR INTO EGGS.

[F. E. EMERY, M. S., Bulletin No. 167, North Carolina Experiment Station.]

Twelve hens were confined in a pen and each fed daily, with other food, one-half ounce of wild onion tops and bulbs in the form of salad from March 16 to 31; from April 1 to 4 they were given a double por-

tion, namely, 1 ounce. The design of this test was to ascertain if the onion salad would flavor the eggs so as to be noticeable, and if so, how long a time would be required to make the flavor noticeable; also, how long can the flavor be detected after the onions are left out of the food. No one participating in testing the eggs could detect anything unusual in the taste previous to March 31, a period of fifteen days after the feeding began. On this date several persons distinctly recognized the flavor of onions. A test was made on April 3, three days after the hens had received a double portion of the onion salad, "and no one could bear the eggs because of the strong flavor." How long eggs will retain the flavor was not determined, but the onion taste was distinctly noticeable as late as four days after they were laid.

A peculiar feature presenting itself in this test was that no white-shelled egg was affected by the flavor of the onions. It was assumed that the hens which laid these eggs had not eaten the onions.

It is a well-known fact that flavor can be fed into meat, and this test shows that it can also be fed into eggs. Professor Emery says: "It seems probable that the hens (Brown Leghorn and Black Minorca) which laid the white eggs refused to eat the onion." A brief experiment would soon give a conclusion to this proposition. He also says that "flavor can be fed into eggs," and that to insure fine-flavored eggs it is necessary to restrict runs for hens to those that will not yield any considerable amount of food that will impart an ill flavor to the eggs.

WEIGHTS OF EGGS OF DIFFERENT BREEDS OF CHICKENS.

[F. E. EMERY, M. S., Bulletin No. 167, North Carolina Experiment Station.]

It has so long been the custom for eggs to be sold by the dozen that the matter of their size has hardly received a thought. In considering breeds of chickens for laying purposes most thought has been given to the number rather than to the size of the eggs produced. Therefore, in an experiment such as the one conducted by Professor Emery, in which it is shown that the marketable value of the eggs of some breeds when this value is based upon weight is 40 per cent greater than that for the eggs of another breed, there attaches no little interest and much importance.

Professor Emery's experiments were with nine breeds of hens and one breed of ducks. The eggs from each pen were collected for the first six months of 1899. The accompanying table shows the number of eggs produced during this period by each breed by both pullets and hens, their average weight, and their weight per dozen.

Number and weight of eggs laid by pullets and hens of different breeds.

Breed.	Pullets.				Hens.			
	Eggs produced.	Average weight.	Weight per dozen.		Eggs produced.	Average weight.	Weight per dozen.	
	Number.	Grams.	Grams.	Ounces.	Number.	Grams.	Grams.	Ounces.
Barred Plymouth Rock.....	506	57.26	687.1	24.2	402	62.17	746.1	26.8
Late-hatched Barred Plymouth Rock.....					554	55.50	666.0	23.5
White Plymouth Rock.....	478	55.74	668.0	23.6				
White Wyandotte.....	680	55.76	669.1	23.6	232	55.40	664.8	23.5
Silver Laced Wyandotte.....	613	58.90	625.8	22.1				
Single Comb Brown Leghorn.....	623	49.50	495.1	17.5	535	52.82	633.8	21.7
Black Minorca.....	354	62.60	751.3	26.5				
Black Langshan.....	827	56.98	683.8	24.1	463	62.52	750.2	26.5
Buff Cochins.....	83	56.96	683.5	24.1	518	55.97	671.6	23.7
Light Brahma.....	412	55.25	663.0	23.4	118	66.23	794.8	28.0
Pekin ducks (old and young).....	448	83.20	998.4	35.6				

The eggs of the ducks, weighing nearly $2\frac{1}{2}$ pounds per dozen, are the heaviest. The largest hens' eggs are those of the Light Brahmas, weighing $1\frac{1}{2}$ pounds per dozen, while the lightest are from Leghorn pullets, weighing a little less than $1\frac{1}{2}$ pounds per dozen. Let it be assumed, as a basis for comparison, that these smallest eggs are worth $13\frac{1}{2}$ cents per dozen, which is equal to 12 cents per pound. The value of eggs from the other breeds is shown in the following table, being calculated at 12 cents per pound:

Relative values of eggs from different breeds of hens.

Breed.	Value at 12 cents per pound.	Percentage above market.
	Cents.	
Single Comb Brown Leghorn pullets' eggs.....	13.5	
Single Comb Brown Leghorn (hens).....	16.3	20.7
Silver Laced Wyandotte (pullets).....	16.6	23.0
Light Brahma (pullets).....	17.54	30.0
Late-hatched Barred Plymouth Rock (hens).....	17.6	30.4
White Wyandotte (hens).....	17.6	30.4
White Wyandotte (pullets).....	17.7	30.4
White Plymouth Rock (pullets).....	17.7	31.1
Buff Cochins (hens).....	17.8	31.8
Black Langshan (pullets).....	17.8	31.8
Barred Plymouth Rock (pullets).....	18.2	34.8
Barred Plymouth Rock (hens).....	19.7	46.0
Buff Cochins and Black Langshan (pullets).....	19.9	47.2
Black Minorca (pullets).....	19.9	47.2
Black Langshan (hens).....	20.44	51.4
Light Brahma (hens).....	21.6	60.0
Pekin duck (from old and young ducks).....	26.7	97.8

Of course, the price of eggs will vary, but the relative differences would remain. The table shows that Pekin ducks' eggs are worth almost twice as much as the eggs of Leghorn pullets. Professor Emery well says:

On what other article of food will people be content to pay the same price for what may vary over 50 per cent in value? Or what producer of merchantable produce of any kind will consent to supply all the way up to 55 per cent more than market value and not think to add to the standard price for additional value?

COST AND VALUE OF EGGS OF DIFFERENT BREEDS OF HENS.

[F. E. EMERY, M. S., Bulletin No. 167, North Carolina Experiment Station.]

This experiment was conducted with nine breeds of hens and one of ducks (several of each breed), and covered the period January 1 to June 30, 1899. A daily record was made of the food eaten, of the number of eggs laid, and of the value of the eggs, based upon the market price. They were fed wheat bran, wheat middlings, wheat screenings, corn meal, corn, oats, crimson clover hay, and green bone. Food was charged at market value. The following table shows the totals of this experiment:

Cost and value of eggs of different breeds of hens.

Breed.	Total cost of food.		Total number of eggs produced.		Total value of eggs produced.	
	Per hen for 6 months.	Average per hen for 1 month.	Per hen for 6 months.	Average per hen for 1 month.	Per hen for 6 months.	Average per hen for 1 month.
Barred Plymouth Rock:	<i>Cents.</i>	<i>Cents.</i>	<i>Number.</i>	<i>Number.</i>	<i>Cents.</i>	<i>Cents.</i>
Late-hatched hens (2 years).....	53.40	8.90	81.54	13.59	87.08	14.51
Pullets.....	59.32	9.887	79.87	13.31	86.29	14.38
Hens (2 years).....	72.33	12.055	59.11	9.852	63.64	10.60
White Wyandotte:						
Pullets.....	37.14	6.19	70.02	11.7	74.25	12.35
Hens.....	49.35	8.225	40.57	6.76	43.54	7.25
Silver Laced pullets	39.75	7.678	80.21	16.04	85.02	17.00
White Plymouth Rock pullets	55.40	9.23	64.13	10.69	66.96	11.13
Black Minorca pullets	37.87	7.574	43.31	8.632	45.72	9.14
Brown Leghorn:						
Pullets.....	29.21	4.87	77.43	12.905	82.64	13.73
Hens.....	38.91	6.485	67.00	11.17	70.33	11.72
Buff Cochins:						
Pullets ^a	18.39	7.07	17.76	6.83	17.76	6.83
Hens.....	64.00	10.67	58.26	9.71	61.25	10.21
Black Langshan:						
Pullets.....	53.41	8.90	88.20	14.70	93.80	15.63
Hens.....	66.12	11.02	72.07	12.01	75.86	12.63
Light Brahma:						
Pullets.....	84.96	14.16	102.03	17.01	100.95	17.65
Hens.....	61.18	10.197	30.56	5.093	30.89	5.15
Pekin ducks	41.60		23.94		24.84	

^a Data for February, March, and 18 days in April only.

SKIM MILK AS FOOD FOR YOUNG CHICKENS.

[W. B. ANDERSON, B. S., Bulletin No. 71, Indiana Experiment Station.]

In order to test the effect of skim milk as food for growing chickens, an experiment was undertaken with 10 Plymouth Rocks and 10 Houdans, and covered a period of eight weeks. One of the broods was two months old and the other one and a half months old at the beginning of the experiment. They were arranged in two lots, each lot containing 5 of each breed. Both lots were given in common all they would eat of the mixed food, consisting of two parts of crushed corn, one part of bran, and one part of ground oats; both lots also received all they would consume of cracked bone, cabbage, lettuce, and water. Lot II was given, in addition, all the skim milk they would drink. The weight of the chickens on July 11, the date on which this investigation was undertaken, and on September 5, the date of the close of the experiment, is shown in the following table:

Table showing weight of chickens in ounces at beginning and ending of experiment.

Lot I—without milk.			Lot II—with milk.		
Number of chickens.	July 11—beginning.	September 5—ending.	Number of chickens.	July 11—beginning.	September 5—ending.
	Ounces.	Ounces.		Ounces.	Ounces.
1.....	19	43	5.....	16	53.5
2.....	16.5		6.....	13	52
3.....	10	36.5	7.....	11	46
4.....	15.5	39	8.....	12	44
5.....	9.5	26	9.....	14.5	50
12.....	10	29.5	11.....	19	68
14.....	9	27.5	13.....	9	38
15.....	14.5	38.5	17.....	12	47
18.....	8	24	18.....	7	37
20.....	9	33	19.....	7	40
Total.....	121	297	Total.....	120.5	475.5
Gain.....		176	Gain.....		355

The weight of Lot I, as shown by this table, was 121 ounces at the beginning of the experiment, and the weight of Lot II was 120.5 ounces, a difference of a half ounce only. At the end of the experiment Lot I had gained 176 ounces and Lot II 355 ounces. The weights of the lots at the end of the seven-day periods and the amount of food consumed during these periods are shown in the table below:

Table showing weights of chickens in ounces and amount of food in ounces consumed during each seven-day period.

Date.	Food consumed.			Weight of fowls.	
	Lot I, mixed feed.	Lot II.		Lot I.	Lot II.
		Mixed feed.	Milk.		
	Ounces.	Ounces.	Ounces.	Ounces.	Ounces.
July 18.....	182.5	285.0	39.0	131.5	152.0
July 25.....	273	301.5	85.5	156	178
August 1.....	344.5	317.5	162.5	180.5	213

Table showing weights of chickens in ounces and amount of food in ounces consumed during each seven-day period—Continued.

Date.	Food consumed.			Weight of fowls.	
	Lot I, mixed feed.	Lot II.		Lot I.	Lot II.
		Mixed feed.	Milk.		
	Ounces.	Ounces.	Ounces.	Ounces.	Ounces.
August 8.....	474.5	498.5	278.5	220	277
August 15.....	412	449.5	231.5	a 216.5	216
August 22.....	384	514.5	290.5	a 220	294.5
August 29.....	408	556.5	216.25	a 270	277
September 5.....	398.5	553	131.5	a 297.5	431.5
Total food consumed (pounds)...	179.8	217.3	90.4	.....	.....

a Combined weight of nine chickens.

These figures show that Lot II not only consumed 37.5 pounds more food than Lot I, but 90.7 pounds of milk as well. The table below shows the gains by weeks for the lots and the average gain for each chicken:

Table showing total gain and the gain of each chicken in ounces by seven-day periods.

Date.	Lot I—without milk.		Lot II—with milk.	
	Total gain.	Average gain per chicken.	Total gain.	Average gain per chicken.
	Ounces.	Ounces.	Ounces.	Ounces.
July 18.....	10.5	1.05	31.5	2.31
July 25.....	24.5	2.45	26	2.00
August 1.....	24.5	2.45	35	2.69
August 8.....	39.5	3.95	64	4.80
August 15.....	24.5	2.73	42	3.20
August 22.....	33.5	3.35	75.5	5.80
August 29.....	20	2.20	43.5	3.30
September 5.....	27.5	2.75	39.5	3.00
Average gain per week.....	.....	2.62	.....	3.04

It is interesting to note that when there is an increased consumption of milk in Lot II there is also a corresponding increase in the average gain during the same period.

The authors summarize their work, as follows:

1. If skim milk be added to the ration fed to young chickens it will increase the consumption of the other foods given.
2. The great increase in average gain was coincident with the periods when the greatest amount of skim milk was consumed.
3. Skim milk is especially valuable as a food for young chickens during the hot, dry weather; and becomes of less importance as the chicken grows older and the weather becomes cooler.

CONTAGIOUS DISEASES OF ANIMALS IN FOREIGN COUNTRIES.

GREAT BRITAIN.

The information under this head is taken from the reports of Mr. Alex. C. Cope, chief veterinary officer, and Mr. J. T. Tennant, assistant secretary of the animals division, published in the report of the board of agriculture for 1898.

REVIEW OF THE HISTORY OF CATTLE PLAGUE, FOOT-AND-MOUTH DISEASE, AND PLEUROPNEUMONIA.

As a result of the measures taken in connection with the final eradication of pleuropneumonia, which for the last two years has been centered in the cowsheds within and around the metropolis, Great Britain is at the present time entirely free from the contagious diseases affecting cattle which during the last sixty years have caused so considerable a loss to stock owners, and, indirectly, to the public. I refer particularly to cattle plague, foot-and-mouth disease, and pleuropneumonia.

In the report for the year 1897 reference was made to the fact that while pleuropneumonia had been stamped out in the country districts, outbreaks still continued to be reported in the cowsheds in the East End of London, and it had become evident that unless some supervision was maintained over and strict inquiry made into the sanitary condition of the cattle therein, it would never be known whether the disease had ceased to exist.

With this object in view, an order was passed prohibiting the movement of cattle out of these cowsheds, except with a license, to a slaughterhouse where the lungs of each animal could be carefully examined by a veterinary surgeon to discover whether any recent or old standing cases were still remaining.

It was only natural that the cow keepers whose interests were seriously affected by this order should have expressed strong objections to the action taken by the board; but when it was pointed out to them that the order was only of a temporary character and would be withdrawn as soon as possible, having a due regard to the object for which it was framed, and that the results must eventually be of a permanent and lasting benefit not only to them, but to every stock owner throughout the United Kingdom, they withdrew their opposition. No doubt they were greatly influenced by the fact that the measures which the board had already taken for eradication of the disease had been very successful, and had saved them from the serious losses to which they had for years past been subjected by the prevalence of the disease among their animals.

The order included a district in the East End of London containing 233 cowsheds, in which it was ascertained there were no fewer than 2,742 cows at the time when it came into force. This extensive area was divided into three districts, each being placed in the charge of a veterinary surgeon whose duties consisted of granting licenses for the removal of cows for slaughter, attending the post-

mortem examinations, and bringing to the laboratory of the board any lungs which, in their opinion, were affected with or suspected of pleuropneumonia. At the time when they commenced their inquiries the inspectors appointed reported that all the cattle in the sheds, with few exceptions, were a fine healthy-looking lot, and presented no clinical evidence of disease in their lungs.

The order remained in force for a period of ten months, during which period 2,052 of the 2,742 cattle which were in the sheds at the time when the examination commenced were slaughtered, and as a result of the postmortem examinations conducted by the veterinary surgeons five cases of pleuropneumonia were detected, chiefly in the old encysted form.

The eradication of all the three diseases I have named may be said to be in many ways of great importance.

In the first instance it has been followed by a withdrawal of all the restrictions, both departmental and local, which were constantly being imposed upon the movement and sale of cattle in various parts of Great Britain at the time when pleuropneumonia was prevalent, and the owners of stock are now no longer subjected to the vexations and annoyances incident upon obtaining and producing movement licenses when required, a proceeding which formerly greatly hampered the farmers and irritated the salesmen in the pursuit of their respective callings—indeed, in days gone by it has often been stated that the restrictions caused more direct pecuniary losses than the disease.

At no period during the last sixty years has the stock of the whole of the United Kingdom been so free from contagious diseases as at the present time, or the trade in cattle been so freely carried on, there being now no order or regulation in force which prevents any farmer or owner of stock from driving his cattle in any direction he may think fit, sending them by rail or road to any part of the country, however distant from his home, or exposing them for sale in any market, fair, or sale yard throughout the country.

But the ordinary stock owner has not alone benefited by this immunity from disease; breeders of pedigree cattle have also reaped great advantages, because their foreign customers know that when purchasing cattle in Great Britain or Ireland they incur no risk of introducing pleuropneumonia or foot-and-mouth disease into the country to which they are taken. In this respect the cattle of the United Kingdom are in better position, from a sanitary point of view, and can be more safely purchased than animals of the same class in almost any other country in Europe.

It is, perhaps, only human that the agriculturists, like the rest of mankind, should soon forget their past troubles, but I can not refrain, at the present somewhat opportune moment, when all the more important diseases of animals, especially of cattle, have been extirpated from the whole of the United Kingdom, from casting a retrospective view on the past and comparing it with the present state of immunity from disease.

Prior to the year 1839 we have no evidence, nor has it, so far as I can ascertain, been recorded, that either of the contagious diseases to which I have alluded had at any time during the present century existed in Great Britain. In that year foot-and-mouth disease, which at first was called the "cattle epidemic," appeared almost simultaneously in the old Smithfield Market in London and in Norfolk, and in the absence of any measures of prevention the disease spread from London and Norfolk to other counties, and was recognized in that year by Professor Simonds in the neighborhood of Twickenham, in Middlesex. With his usual instinct for inquiry he at once conducted experiments to test the contagious nature of the disease, and succeeded in infecting his own cows by feeding them with hay saturated with the saliva of one of the diseased animals. He also communicated the disease to some of the young pigs on his own farm by feeding them with the milk of his diseased cows.

In the following year, 1840, pleuropneumonia appeared in Ireland, and subsequently found its way into England, where it prevailed among the cows in the London sheds about the year 1842.

From these dates, 1839 and 1840, both these diseases, in the absence of any kind of restriction, spread throughout the length and breadth of the land. No one knew how they were introduced, and it does not appear that those who should have been most concerned took any interest whatever in the subject.

The calm indifference, I may say resignation, which the agriculturists as a whole displayed while these two diseases were marching through the land appears to us now as absolutely marvelous, but so changed are they in their views at the present time that I do not hesitate to say that if it were announced in the daily press that foot-and-mouth disease had suddenly appeared in the Metropolitan Market and in one or more other centers, not a few of the agricultural representatives in the House of Commons would, on the following day, put a series of questions to the President of the Board of Agriculture, as to how the disease had been introduced, whether it was spreading, and what steps he, not the local authority as aforetime, had taken to check its progress.

The lack of interest in their personal affairs at the time to which I refer may possibly be explained by the fact that the raising and feeding of cattle was then, perhaps, of less importance to the farmer than the production of various kinds of cereals. Between 1839 and 1865, at which latter date the cattle plague was first introduced and legislation for the prevention of animal diseases commenced, wheat averaged somewhere about 54s. a quarter, and had been as high as 74s., while oats and barley were at comparatively high prices, the inference being that the affairs of life generally worked very smoothly with the farmers in those days. During all these years both foot-and-mouth disease and pleuropneumonia were quietly extending throughout the country without disturbing the minds of the agriculturists, when suddenly the cattle plague arrived and threatened, in the absence of any sanitary legislation, to sweep off nearly all their horned stock.

The extent to which foot-and-mouth disease existed, and the loss it caused between 1839 and 1870, can not be accurately estimated in the absence of any authentic returns. It may, however, be accepted that the disease comported itself during that period in very much the same manner as it did in after years, having its periods of rise and decline, the former following upon the latter in proportion to the number of fresh susceptible animals which became available as each new generation was produced.

A somewhat approximate estimate may, however, be formed of the number of animals which were attacked between 1839 and 1870, by examining the returns of later years when serious attempts were first made to check the progress of the disease.

The first returns of foot-and-mouth disease were collected by the Department in 1870, thirty years after it had been introduced, and the number of animals of all kinds reported to have been attacked in the first two years amounts to the appalling total of 1,149,124. Assuming that the number attacked annually during the previous thirty years was only one-sixth of that named, it would amount to very nearly 6,000,000. Between 1870 and its final extinction, in 1894, there is reason to believe, from the available returns and other sources, that about 4,500,000 animals fell with the disease, making the gross total between the time of introduction and its final eradication something between ten and eleven millions in Great Britain alone.

I have alluded to the fact that pleuropneumonia is believed to have been introduced into Great Britain at some date prior to 1842, from which period till 1870 there are no records as to the extent to which it prevailed or the number of animals which were attacked and died from the disease. It is recognized that pleuro-

pneumonia is a disease which is only communicated by the agency of the living diseased animal, and it could not, therefore, have spread with the same rapidity as foot-and-mouth disease. It was, however, known to be very rife in many parts of Great Britain and Ireland at the time when the cattle plague arrived, in 1865, more particularly in the cowsheds of the great cities. In those days each individual, when he found the disease among his stock, adopted the "caveat emptor" principle; he slaughtered the diseased and sent his contact animals to market, a system which may be regarded as the most perfect and certain method of spreading any infectious disease, but as this practice had become very common for some years prior to the introduction of legislation for diseases of animals, in 1866, many of the cow keepers found to their dismay that when buying in fresh animals they had purchased infected stock, and I have a distinct recollection, even since slaughter and compensation have been in force, of some of our large cow keepers in the neighborhood of London having the disease on their premises for a period of three or four years. In the absence of any records of the number of cattle attacked with pleuropneumonia in each year prior to 1870, only an approximate estimate can be made of the number of cases during the first thirty years after its introduction. I find, however, that during the first three years when returns of pleuropneumonia were compiled, viz, 1870, 1871, and 1872, the average number of cattle attacked in each year was about 6,000.

Recognizing and admitting that the disease is one calculated to spread very slowly, it may, I think, be reasonably assumed that the average attacks yearly during the previous thirty years could not have been very far short of 1,500, in which case the total during that period would amount to about 45,000. It must, however, be borne in mind that these calculations are only based upon the returns received from the local authorities in Great Britain; and as it is well known that during the whole of that period the disease existed extensively in various parts of Ireland, this number may be regarded as well within the mark.

Of one fact we are quite certain, namely, that since 1870 and up to the final eradication of the disease last year, the number of animals reported attacked in Great Britain has amounted to 79,222; of these, 7,130 died and 65,326 were slaughtered. This would swell the total number attacked in Great Britain alone during the fifty-seven years the disease existed in this country to 124,222. To these must be added 73,300 healthy cattle which were slaughtered as being in contact between 1870 and 1898.

The advent of the cattle plague in 1865 marked an important era in the history of contagious diseases of animals in this country. Unlike foot-and-mouth disease and pleuropneumonia, it proved from the moment of its arrival to be of an extremely fatal character, a very large percentage of the animals affected dying before the tenth day after the exposure to infection. The disease was infectious in the highest degree and capable of being transmitted to healthy cattle in every conceivable way. It was introduced by a comparatively small cargo of Russian cattle brought to Hull from the port of Revel, in the *Baltic*, several of them being moved to the London market at a time when it was a large center for the purchase of store cattle as well as dairy cows and fat stock.

The disease was not recognized at the time when the animals were landed, there being very few veterinarians in this country who at that time had any knowledge of, or had seen cases of, cattle plague. The cattle were exposed for sale in the London market on June 1, but it was not until June 27 that its presence was recognized among some dairy stock in London sheds. During this interval the infection had been distributed to many other centers. It was not, however, until July 11 that the Government became officially acquainted with the fact that cattle plague had appeared in London. Subsequently it was ascertained that in the interval it had found its way as far south as Devonshire, and had appeared in

the counties of Norfolk, Suffolk, and Shropshire, its distribution being mainly due to the removal of stores from the Metropolitan cattle market, and in the same month Kent, Northumberland, Sussex, Hampshire, Staffordshire, Flint, and Essex became infected in their turn. The disease continued to extend with marvelous rapidity, so much so that in the week ending December 30, only six months after its introduction, upward of 10,000 animals were returned as attacked. In January and February, 1866, it became still more prevalent, and the returns show that at the end of the latter month, when it had arrived at its maximum, the number of animals attacked in one week was considerably over 17,000, of which no fewer than 12,000 died. At the close of 1866, when the disease was nearly eradicated, the records of the Department show that during the nineteen months of its visitation 278,439 cattle had been attacked; of these 133,455 died, 99,686 were killed, and the remainder were said to have either recovered or were unaccounted for. It must also, however, be borne in mind that when it first appeared thousands of animals must have died which were not included in this list, there then being no arrangements in existence for obtaining returns.

The fatal nature of cattle plague aroused not only the agricultural but also the public interest, and one and all joined in the demand for its extirpation. Its excessive fatality contributed greatly toward its speedy extinction, because it was impossible to conceal a disease which caused the death of a number of animals of comparatively large value, and the owners were only too pleased to call in the aid of the authorities, who, after the disease had reached its maximum, were authorized to slaughter and pay compensation, which in many cases saved the agriculturist from utter ruin. It has been estimated that the direct monetary loss from this first outbreak of cattle plague could not have been less than £4,000,000, and many have assessed the indirect losses at an equal amount.

It is an old saying that "Out of evil good comes," and this axiom has never been exemplified with greater force than in this particular case. The agriculturists and the public then for the first time realized the serious direct losses which follow upon the introduction of a fatal disease like cattle plague, and it is extremely doubtful whether any legislative measures would ever have been adopted for the suppression of the contagious diseases of stock if the cattle plague had not been introduced in 1865. I may here remark that cattle plague was again introduced in the years 1872 and 1877, on the first occasion by cattle which were again imported from Russia into Hull, and on the second by cattle brought from Germany into Deptford. Having profited by the experience of the first outbreak, and being possessed of an experienced staff, the Government, by prompt measures and speedy detection of every center, were enabled to extinguish the 1872 outbreak within three months by the slaughter of only 171 cattle, exclusive of 72, which were affected with the disease. The outbreak of 1877 lasted for six months, during which period 835 cattle were slaughtered, exclusive of 263, which were diseased. The latter outbreak was mainly confined to the cattle in the sheds within the metropolis, where the disease is more easily concealed than in the rural districts.

This very brief account of the disastrous effects which the various contagious diseases of animals have had upon the agricultural interests of this country is sufficient to justify the action which the Government have felt it necessary to adopt at various times for the purpose of suppressing such diseases at home, and, which is of still greater importance, their reintroduction from abroad. It must be admitted that the present immunity from disease has been greatly aided by our insular position, but it could never have been maintained but for the exclusion of all animals coming over from countries in which these transmissible diseases exist. Further, the practicability of enforcing total prohibition from infected countries has been greatly facilitated by Great Britain's capability of providing a supply of live animals for food purposes through our huge merchant fleet, which now trans-

ports to this country a supply of live animals and other food products more than equivalent to that lost by prohibiting the landing of animals from infected countries.

SWINE FEVER.

An explanation is made by Dr. Cope of the difficulty of eradicating swine fever by the stamping-out process. Several difficulties are mentioned, the chief one being the fact that many animals have the disease in such a mild form as not to be apparent upon casual observation, yet are capable of communicating it to other animals. Dr. Cope says that while the time is not apparently near when the disease is likely to be eradicated, he is gratified to state that the number of outbreaks, which was 5,682 in 1894, was reduced to 2,514 in 1898. During the year 1898, 17,124 reports of swine fever were received, and in each instance an inquiry was made into the nature of the disease; however, 90 per cent of the reports proved to be unfounded.

Interest is manifested in the serum experiments being conducted by this Bureau, "and a hope exists that this system may prove to be effective in preventing the spreading of swine fever."

RABIES.

Since 1897 the authorities have been endeavoring to eradicate rabies from the country, not only in the interest of the canine race, but also that of the human being. The muzzling order was enforced wherever necessary in the judgment of the authorities, and inspectors were employed to trace dogs that had been in contact with rabid dogs. Where such dogs were not killed they were isolated for a period of six months. The efforts in this direction are said to have met with marked success, and Dr. Cope says that "unless the disease be again introduced from without, the date of its final eradication is apparently not far distant."

Seventeen cases of rabies were reported to the board of agriculture and confirmed in 1898, and 87 dogs were destroyed as having been exposed to the infection. It is not noted in this report that there were 102 cases of rabies in Ireland in 1898.

GLANDERS AND FARCY.

A gradual decrease in the number of cases of glanders since 1893 is noted. In 1898 the number of animals attacked was 1,385. Of this number 1,199 occurred in Middlesex County, including London, and the county of Lanark, including Glasgow.

CONTAGIOUS PLEUROPNEUMONIA.

Only one outbreak of this disease was reported in 1898 as against seven in 1897. As a consequence, 220 cattle were slaughtered. Says Dr. Tennant in this connection: "It is satisfactory to note that, since

the outbreak referred to, no single case of the disease has been detected in any part of the country, and the whole of Great Britain is now entirely free from any general restrictions in connection with the disease."

SHEEP SCAB.

The outbreaks of sheep scab numbered 2,514, a small increase over 1897. More attention is now being given to the disease than heretofore.

FRANCE.

In France the official reports show that there were 206 outbreaks of contagious pleuropneumonia in 1899, being an increase of 96 over 1898. Aphthous fever, or foot-and-mouth disease, as will be noticed by the tabular statement, was alarmingly prevalent during every month of the year, reaching its greatest height in September with 8,780 cases. The total number of cases for the year was 43,098 as against 9,458 in 1898. The number of cases of rabies increased from 1,781 in 1898 to 2,374 in 1899.

Contagious diseases of animals in France during the year 1899.

Name of disease.	Janu- ary.	Febru- ary.	March.	April.	May.	June.	July.
Contagious pleuropneumonia:							
Number of outbreaks.....	18	15	20	19	18	16	6
Number slaughtered.....	68	30	51	30	38	37	13
Number inoculated.....	213	83	139	87	80	23	15
Aphthous fever (outbreaks).....	2,367	2,073	1,835	1,336	1,355	3,072	4,168
Sheep scab (outbreaks).....	131	100	45	19	19	25	7
Sheep pox (outbreaks).....	51	12	20	11	17	19	21
Blackleg (outbreaks).....	75	94	60	64	57	53	42
Glanders and farcy (outbreaks).....	75	49	75	80	83	69	44
Rabies (cases).....	202	168	204	296	198	178	112
Rouget (outbreaks).....	29	12	10	15	12	17	12
Hog cholera (outbreaks).....	8	19	16	11	12	16	9
Anthrax (outbreaks).....	33	32	25	33	34	42	77

Name of disease.	August.	Septem- ber.	October.	Novem- ber.	Decem- ber.	Total.
Contagious pleuropneumonia:						
Number of outbreaks.....	20	11	26	18	19	206
Number slaughtered.....	75	25	65	46	38	514
Number inoculated.....	60	10	218	75	101	1,183
Aphthous fever (outbreaks).....	7,167	8,780	6,088	3,203	1,653	43,098
Sheep scab (outbreaks).....	4	80	13	6	14	463
Sheep pox (outbreaks).....	26	22	60	14	57	330
Blackleg (outbreaks).....	55	67	80	114	71	832
Glanders and farcy (outbreaks).....	53	64	60	62	62	776
Rabies (cases).....	203	261	244	217	191	2,374
Rouget (outbreaks).....	23	14	20	90	24	278
Hog cholera (outbreaks).....	10	15	9	11	15	151
Anthrax (outbreaks).....	64	41	47	53	41	522

SWITZERLAND.

The statistics given herewith are from the official statement issued by the Swiss Government. The general condition of diseases of animals there was, on the whole, much better than in the previous year of 1898. There was, however, an increase of 175 cases of blackleg, of 454 cases of rouget, and of 53 cases of glanders. A decrease of 18 in the number of cases of anthrax is shown, and of 645 cases of sheep scab. The decrease in the number of cases of foot-and-mouth disease was most gratifying, as this disease was severe in most European countries during the previous year. The showing of dead and infected cattle from this disease was 38,304 cases, against 106,884 in 1898, being a reduction of 68,580 cases. In 1899 there were but 2 cases of rabies, while in 1898 there were 119.

Deaths from contagious diseases among domestic animals in Switzerland in 1899.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Blackleg	11	8	15	17	25	84	193	173	173	81	25	15	829
Anthrax	22	27	24	25	23	19	30	55	49	24	12	14	224
Foot-and-mouth disease:													
Large cattle <i>a</i> ...	79	55	110	9	9	27	3	10	23	22	52	103	567
Small cattle <i>a</i> ...	20			3							2	12	37
Glanders	21	2	19	10	16	1	3	3		1	9	10	85
Rouget	164	208	111	162	124	193	269	253	223	152	233	135	2,222
Sheep scab <i>b</i> ...			8	101	4	4		220					337

a Dead and infected.*b* Infections.

GERMAN EMPIRE.

Number of localities and farms infected with contagious diseases of animals in 1899.

	January.	February.	March.	April.	May.	June.	July.
Foot rot of sheep:							
Localities	49	46	42	57	58	53	6
Farms	62	54	63	69	70	64	79
Foot-and-mouth disease:							
Localities	2,616	2,556	4,106	6,033	6,578	6,723	7,398
Farms	7,308	6,741	12,412	19,237	23,617	20,485	31,518
Hog cholera, including swine plague:							
Localities	326	411	515	504	570	519	558
Farms	413	520	644	623	708	685	66
Pleuropneumonia:							
Localities	28	28	29	29	22	18	14
Farms	37	35	40	35	27	19	15

GERMAN EMPIRE—Continued.

Number of localities and farms infected with contagious diseases of animals in 1899—Continued.

	August.	September.	October.	November.	December.	Total.
Foot rot of sheep:						
Localities	71	78	70	65	63	714
Farms	80	82	75	83	80	832
Foot and mouth disease:						
Localities	7,798	8,515	9,177	11,176	9,480	82,305
Farms	38,398	43,577	42,417	50,076	38,671	293,457
Hog cholera, including swine plague:						
Localities	475	421	367	302	249	5,175
Farms	761	625	553	408	361	7,057
Pleuropneumonia:						
Localities	15	16	13	11	11	234
Farms	16	19	17	17	15	292

HUNGARY.

The following statistics for 1898 are taken from the Jahresbericht über das Veterinärwesen in Ungarn, 1898:

ANTHRAX.

The existence of anthrax was officially reported in 57 counties and on 1,439 farm premises. There were 216 horses affected, 1,888 cattle, and 1,110 sheep. The figures so nearly parallel those of 1897 as to be striking. In 1897 the number of farm premises where the disease was definitely established was 1,426; horses affected, 209; cattle affected, 1,889; sheep affected, 968. All of the 216 horses died in 1898, all of 1,110 sheep, and all but 23 cattle. A further comparison is shown in the following table:

Kind of animal.	1895.		1896.		1897.		1898.	
	Af-fected.	Died.	Af-fected.	Died.	Af-fected.	Died.	Af-fected.	Died.
Horses	250	227	191	190	209	197	216	216
Cattle	2,571	2,219	1,780	1,703	1,889	1,730	1,888	1,865
Sheep	1,157	1,156	1,074	800	968	968	1,100	1,110
Total	3,978	3,602	3,045	2,693	3,066	2,894	3,204	3,191

RABIES.

This disease affected 1,219 dogs, 4 cats, 11 horses, 35 cattle, 7 sheep, and 51 hogs. The document mentioned states that "76 dogs and sheep died, 978 were killed, and 169 escaped." As only 7 sheep were

affected, it will be seen that the deaths were principally among dogs. A comparison of affected animals with previous years follows:

Kind of animal.	1895.	1896.	1897.	1898.
Dogs	1,227	1,274	1,282	1,210
Cats				1
Horses	13	14	22	11
Cattle	60	74	120	55
Sheep	1	8	40	7
Hogs		63	53	51

The number of dogs suspected (having been bitten) and killed in 1896 was 3,826; in 1897, 3,196; in 1898, 3,997. In 1898, 226 other animals which had been bitten were killed before the disease developed.

GLANDERS.

Glanders was reported from 674 farm premises, and 1,683 horses were affected. Of this number, 1,661 were killed and 22 died of the disease. In addition 62 suspected horses were killed, making a total loss of 1,745 horses. This was 0.09 per cent of the total number of horses in Hungary. The following statement affords comparisons with former years and gives totals of horses that were killed or had died of the disease:

1895	1,241
1896	681
1897	931
1898	1,745

Thus it will be seen that the number of cases nearly doubled in 1898.

FOOT-AND-MOUTH DISEASE.

The number of farm premises where this disease was found in 1898 was 9,998, and the number of animals affected 33,649—cattle, 28,832; sheep, 3,806; hogs, 1,011. Deaths out of these numbers, 110 cattle, 95 sheep, 1 hog. The number of counties affected in 1898 was 48, while the number was 50 in 1897 and 63 in 1896. A comparison is given below of the number of affections for the years 1895 to 1898, inclusive:

	1895.	1896.	1897.	1898.
Cattle affected	282,282	572,809	70,491	28,832
Sheep affected	25,620	178,612	25,450	3,806
Hogs affected	59,940	82,931	3,758	1,011
Total	367,842	834,352	99,699	33,649

PLEUROPNEUMONIA.

This disease was identified on 26 farm premises, the number of cases being 63. All affected animals were slaughtered by the authorities. Besides the 63 sick cattle, 254 others were killed at once as suspicious, and 2,279 sent to the slaughterhouse on account of having been exposed to the contagion. Aside from these there were in 9 other counties 327 cattle slaughtered and 10 sent away because of suspicion. The total, therefore, was 2,933 head. The following table presents figures for comparison with other years:

Disposition of cattle.	1896.	1897.	1898.
Died and slaughtered as affected.....	313	262	390
Slaughtered as suspicious.....	781	735	254
Exposed (sent to slaughterhouse).....	7,563	4,580	2,289
Total.....	8,657	5,577	2,933

SHEEP POX.

The number of sheep affected with sheep pox was 5,401, being reported from 239 farm premises. This is a decrease over 1897 of 4,135 cases and 53 farm premises. Of the 5,401 sheep affected, 4,832 recovered, the remainder having died of the disease or were killed. The death rate among the affected animals was 10.5 per cent, as against 16 per cent in 1897 and 37.1 per cent in 1896.

	1895.	1896.	1897.	1898.
Sheep affected.....	2,274	938	9,536	5,401
Sheep died.....	265	254	1,526	569
Farm premises reported.....			292	239

FOOTHALT.

In the county of Abauj-Torna foothalt appeared (in June) in the 3 government stallions and 40 mares, and by the end of the year 69 horses were affected. In the county of Csanád there were 2 cases, making a total of 71.

BLISTER UPON THE GENITALS.

This disease appeared on 433 farm premises in 19 counties, and 137 horses and 492 cattle were affected. This was a large increase over 1897, being 200 more farm premises, 56 more horses, and 358 more cattle. The statistics for several years are shown in the table below:

	1895.	1896.	1897.	1898.
Horses affected.....	79	118	81	137
Cattle affected.....	338	217	134	492
Counties reported.....		15	16	19
Farm premises reported.....		238	143	433

SCAB.

Scab existed upon 633 farm premises in 44 counties. There was a slight decrease in the disease among horses and a large increase among sheep. The table herewith gives figures for comparison for the years 1895 to 1898, inclusive:

	1895.	1896.	1897.	1898.
Horses affected.....	2,500	1,713	970	90
Cattle affected.....	32	119	4	.....
Sheep affected.....	4,003	4,156	3,222	6,43

RED MURRAIN OF SWINE.

Red murrain of swine was reported from 1,748 farm premises in 46 counties. The number of hogs attacked was 7,624. A comparison with 1897 shows 1,016 fewer farm premises, 3,444 fewer animals affected, and 3 fewer counties.

	1896.	1897.	1898.
Hogs affected.....	28,806	11,068	7,624
Counties reported.....	52	49	4
Farm premises reported.....	.....	2,764	1,748

HOG CHOLERA.

Hog cholera appeared on 40,951 farm premises in 59 counties. A comparison of data follows:

	1896.	1897.	1898.
Hogs attacked.....	808,777	514,291	318,000
Hogs died of the disease.....	639,765	360,838	236,445
Hogs killed.....	13,003	5,201	2,827
Farm premises reported.....	.....	84,823	40,951
Counties reported.....	56	60	59

BUFFALO CHOLERA.

There were 313 cases of buffalo cholera reported on 105 farm premises. Data for comparison with other years follow:

	1895.	1896.	1897.	1898.
Cases reported.....	206	350	99	313
Farm premises reported.....	.....	153	69	105

DENMARK.

The contagious diseases of animals in Denmark during the year 1899 existed to about the same extent as in 1898 and 1897. The table herewith shows the figures from the official reports, by months except for April and June:

Cases of contagious diseases of animals in Denmark during the year 1899.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Anthrax	18	17	17	.....	14	.....	11	7	2	9	10	9	111
Foot and-mouth disease .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1
Cerebro-spinal meningitis	2	.....	2	.....	1	.....	2	2	5	3	3	4	23
Malignant catarrhal fever	3	4	7	.....	7	.....	16	11	8	7	7	4	74
Glanders .....	.....	.....	.....	.....	2	.....	.....	.....	9	.....	3	.....	14
Swine plague or hog cholera	3	.....	1	.....	3	.....	1	2	5	6	1	.....	22
Rouget:													
Acute	46	33	35	.....	47	.....	59	78	85	95	76	103	657
Chronic	18	10	11	.....	3	.....	6	7	16	22	23	21	137
Nodular erythema	62	69	43	.....	67	.....	202	320	535	408	287	85	1,669

BELGIUM.

The official reports of contagious diseases of animals in Belgium are not very different from the reports in the previous year. The number of cases of glanders and farcy increased from 138 in 1898 to 406 in 1899. Foot-and-mouth disease, which increased alarmingly during the last four months of 1898, showed some abatement in 1899, until only 269 cases were reported for December.

Cases of contagious diseases of animals in Belgium during the year 1899.

Name of disease.	January.	February.	March.	April.	May.	June.	July.
Glanders and farcy	15	43	35	50	31	40	19
Foot-and-mouth disease	1,204	568	499	358	310	811	1,609
Rabies	59	25	47	39	33	18	19
Anthrax	27	29	26	28	30	34	25
Foot rot .....	.....	40	8	.....	15	81	20
Sheep scab .....	.....	*	.....	.....	.....	.....	28

Name of disease.	August.	September.	October.	November.	December.	Total.
Glanders and farcy	33	27	44	33	36	406
Foot-and-mouth disease	3,594	3,928	1,797	840	269	10,127
Rabies	32	34	16	20	102	404
Anthrax	27	23	27	34	20	230
Foot rot	1	.....	213	14	60	487
Sheep scab .....	.....	.....	.....	.....	100	128

NETHERLANDS.

In the Fifteenth Annual Report of the Bureau the statistics relative to the presence of contagious diseases in Netherlands were published for 1897, and also for 1898, but somewhat incomplete. Foot-and-mouth disease, which raged throughout the year 1897, showing 603,623 cases in official reports, and which decreased to about 12,000 in 1898, show an increase over the latter year in 1899. The number of cases in this year was 119,764.

Cases of contagious diseases of animals in Netherlands during the year 1899.

Name of disease.	January.	February.	March.	April.	May.	June.	July.
Foot-and-mouth disease.....	2,229	2,332	2,197	4,309	13,084	20,945	19,922
Farcy or mange.....	1	5	9	8	4	5	4
Sheep scab.....	420	225	158	196	86	105	208
Rouget.....	9	8	4	12	27	20	135
Anthrax.....	28	30	18	22	25	27	23
Foot rot of sheep.....	55	49	45	2	4	15	138

Name of disease.	August.	September.	October.	November.	December.	Total.
Foot-and-mouth disease.....	20,582	19,558	7,418	4,630	2,608	119,764
Farcy or mange.....	7	8	6	1	7	65
Sheep scab.....	112	1,068	751	342	303	3,944
Rouget.....	63	503	99	48	53	981
Anthrax.....	15	37	19	21	24	289
Foot rot of sheep.....	19	36	55	23	13	454

NORWAY.

This report is compiled from the official statistics of the Norwegian Government for 1897. The following statement gives the number of cases of sickness reported among animals for the year named:

Horses.....	13,745
Cattle.....	37,343
Sheep.....	1,069
Goats.....	268
Hogs.....	4,384
Dogs.....	771
Cats.....	105
Fowls and other animals.....	182
Total.....	57,867

There were no cases of bovine plague (pest) or canine rabies; no cases of glanders, apthous fever, or pleuropneumonia of cattle; no cases of foot rot or scab of sheep.

There were 385 cases of anthrax noted, the greater number of them being found in the province of Londre Bergenhus. The veterinarians attribute the disease to the débris from the mills. M. Lekven fed such refuse to three sheep, two of which died at the end of two months.

Of symptomatic anthrax (blackleg) 18 cases were reported, and 311

cases of coryza (catarrh in cattle). This latter disease appears every year in a valley of Londre Bergenhus, where it frequently assumes a very grave character. In a stable of 10 cattle all were infected, and all died except such as were slaughtered in the meantime.

There were reported 7 cases of edema (soft swelling), 75 of "braasot" (gastronosis in sheep), and 908 of rouget.

In May there was a limited outbreak of epizootic pest among hogs near Christiania. The infected herds were slaughtered. The total number of cases reported was 177, of which 14 were in the department of Jarlsberg and Larvik, whence the contagion was communicated directly to Christiania.

During the year 1898, 1,465 herds of cattle, with a total of 14,740 animals, were examined for tuberculosis. The number of herds found to be affected was 331, and the number of individual animals 725; that is, 22.6 per cent of the herds and 4.92 per cent of the total number of animals.

In addition to the diseases mentioned in this report by the Norwegian Government, it is of interest to note that the veterinarians are agreed that the treatment of vitulaire (puerperal) fever by the methods of the Danish veterinarian M. Schmidt gives most excellent results.

In the budget for 1897-98 it is shown that the sum expended for veterinary service was 123,696 crowns (about \$135,065).

Cases of contagious diseases of animals in Norway during the year 1899.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Anthrax.....	20	26	31	35	45	30	38	97	27	22	16	18	480
Blackleg.....	3	1	1	3	.....	2	6	3	1	3	4	1	28
Braxy.....	4	4	2	6	3	16	.....	5	5	5	14	10	74
Malignant catarrhal fever of cattle.....	12	26	31	32	35	30	29	27	22	14	8	17	285
Rouget.....	48	28	41	39	33	34	97	137	134	96	100	47	634
Infectious pneumonia of swine.....	.....	.....	.....	22	26	.....	10	7	.....	.....	.....	.....	65

NEW ZEALAND.

The facts herewith are taken from the report of the veterinary division of the New Zealand department of agriculture for 1898-99.

TUBERCULOSIS.

Dr. J. A. Gilruth, chief veterinary officer and bacteriologist of the New Zealand department of agriculture, states that it is now proved that the disease is prevalent to an extent greater than was originally anticipated. He tested 1,500 cattle, chiefly dairy cows, and found that 15 per cent reacted. It is stated, however, that as the herds

tested were under suspicion this percentage is higher than the normal.

Dr. A. Park, a government veterinarian, says in his report that "it can no longer be doubted that tuberculosis is prevalent to a more or less degree in the colony." The several tests reported by Dr. Park show that the percentage of reactions varies greatly in different sections. Dr. C. J. Reakes, a government veterinarian, also makes a report, in which he states that during the past two years he had tested 3,712 head of cattle for tuberculosis, and those which reacted equaled about 14 per cent. Dr. Reakes also says that tuberculosis is very frequently met with among pigs, "the prevalent practice of feeding them upon the by-products of dairy factories, and especially the offal from slaughterhouses, being undoubtedly responsible for its dissemination."

The Government proposes to assist in eradicating tuberculosis from the cattle herds, but requires the owners to pay the cost. The following are the conditions upon which the department of agriculture will undertake the testing of cattle for tuberculosis on owner's application:

1. The inspector shall arrange for an examination of the herd, to be made as soon as possible after receiving the application.

2. The owner shall supply all necessary assistance and appliances for the carrying out of the test.

3. The owner shall agree to keep entirely separate for such period as the inspector shall direct all animals which it may be decided to isolate, and to earmark or brand same as directed. The isolation must be carried out to the satisfaction of the inspector.

4. Should the owner decide to slaughter any animal which the inspector has decided to isolate, he shall not be entitled to any compensation for same.

5. In the case of isolated cows in milk, the owner shall not dispose of the milk or milk product unless with the written authority of an inspector.

6. The owner is liable to a penalty if he disposes of any diseased animal without the written authority of an inspector.

7. The owner shall carry out the instructions of the inspector in regard to disinfection of premises.

8. The owner shall undertake not to allow any animal which has been passed by an inspector to come into contact with any animal that it has been decided to isolate or has not been submitted to the tuberculin test.

9. A charge of 6d. per head for all cattle tested will be made to cover cost of tuberculin, the minimum charge being 5s.

10. Should any owner refuse to comply with the above conditions after having made formal application, he shall be liable for all expenses the department may have incurred in connection with the application.

11. The attached form of application must be signed by the owner or authorized representative.

SWINE FEVER.

This appears to be a general term for the two diseases known in the United States as hog cholera and swine plague. It is reported as having first appeared in New Zealand in 1894, but its prevalence at this time is not stated, although it is reported from several sections.

NOTE ON THE CHICKEN TICK (*ARGAS AMERICANUS*).

By ALBERT HASSALL, M. R. C. V. S.,

Acting Assistant Zoologist, Bureau of Animal Industry.

Next to man the chicken is probably more parasitized than any of the domesticated animals. While none of the species which infest it are hard to control if due diligence is exercised, the fact remains that thousands of chickens die annually from the invasion of one or another parasite, or, if they are not killed, are reduced to such a condition as to

render them wholly unprofitable. This is true not only of the internal but also of the external parasites. Everyone who has kept chickens has probably had some experience with gapeworms, and knows how difficult it is to rid the flock of them and how very fatal they are to young chicks. The same may be said of intestinal worms. While the symptoms are not so apparent in this latter form of parasitic disease, the death rate is often as high, especially where the true condition is not detected. With the external parasite there is probably no chicken raiser who has not had some experience, usually a bitter one; for wherever there is a flock, there are bound to be lice, and it will depend entirely upon the energy of the owner

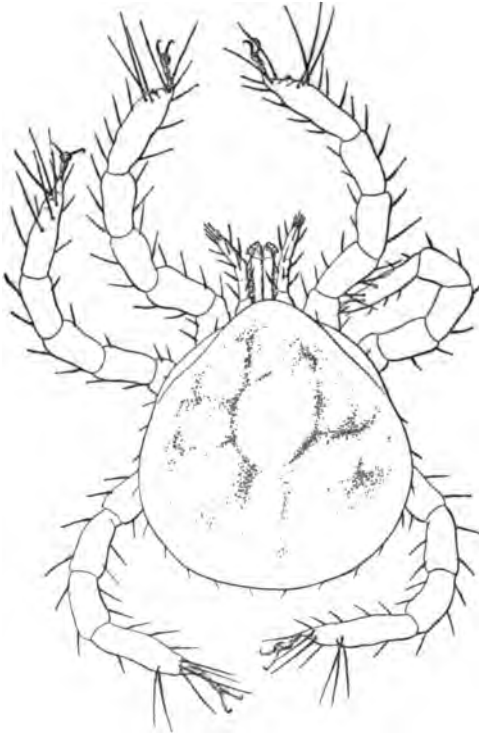


FIG. 16.—*Argas americanus*. Six-legged stage, dorsal view.

whether the insects increase or are kept down to a point where they can do no appreciable damage.

Of the external parasites there are two kinds—the ones which eat the feathers, known technically as Mallophaga; and the blood suckers, part of which belong to the Arachnida and others to the Insecta. If the chickens are provided with a good dusting place they will themselves



FIG. 1. ARGAS AMERICANUS. FEMALE. DORSAL VIEW.



Holmes, del.

A. Hoen & Co., Lithocraft.

FIG. 2. ARGAS AMERICANUS. FEMALE. VENTRAL VIEW.

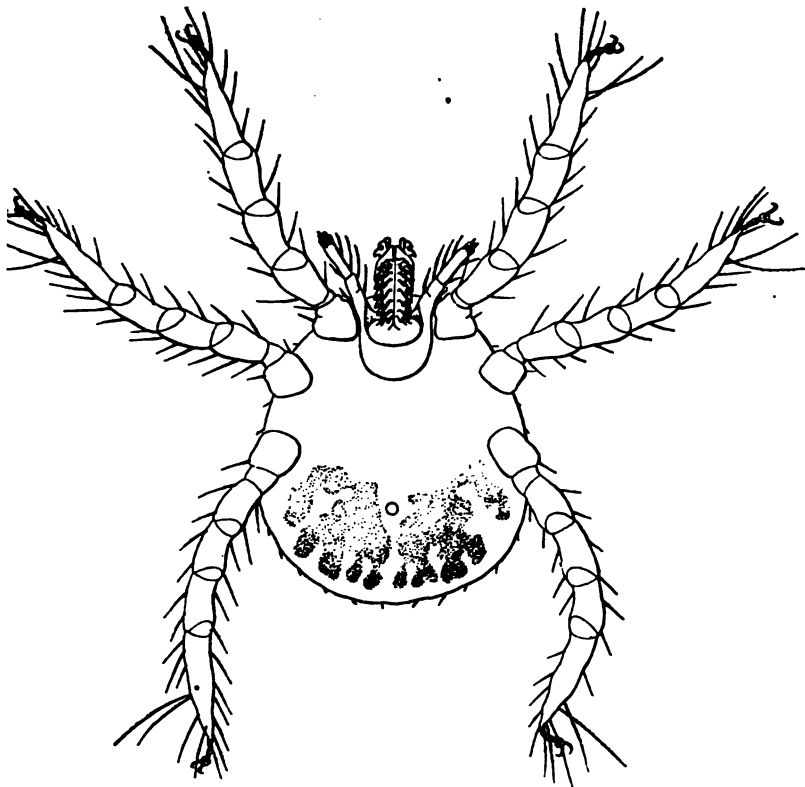


FIG. 17.—*Argas americanus*. Six-legged stage, ventral view.

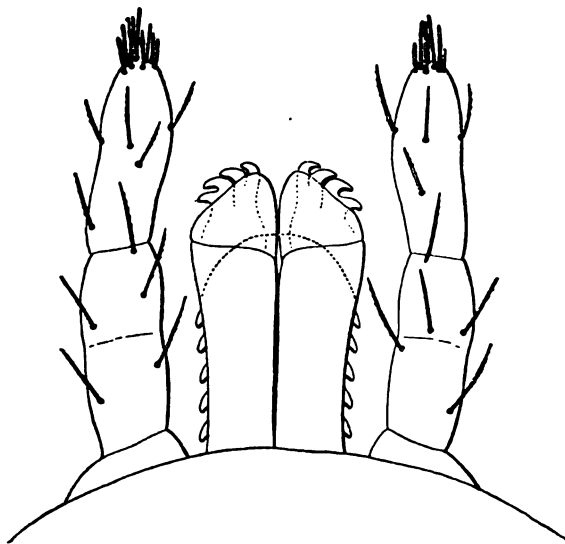


FIG. 18.—*Argas americanus*. Mouth parts. Six-legged form, dorsal view.

take care of the feather-eating varieties; but those infested with blood-sucking parasites must be assisted, and it is only by the continued application of the most approved remedies that the insects can be

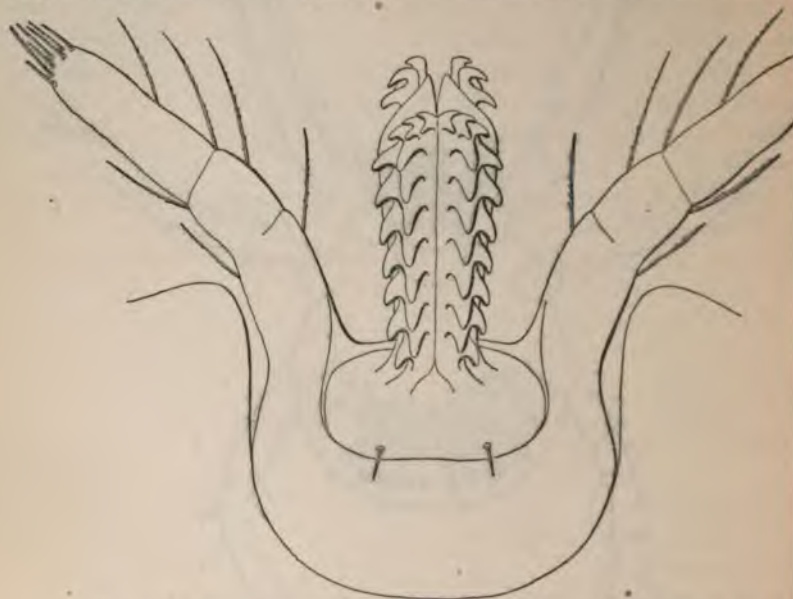


FIG. 19.—*Argas americanus*. Mouth parts. Six-legged form, ventral view.



FIG. 20.—*Argas americanus*. Dorsal view, first leg.



FIG. 21.—*Argas americanus*. Ventral view, first leg.

under control. If they are not controlled, the birds are soon reduced to such a condition of poverty that they cease to lay, and, in the case of young birds, the growth is retarded to such an extent that

never become fully developed; furthermore, they remain weak, and easily succumb even to the mild forms of bacterial disease. The blood-sucking parasites are periodic in their attacks; they do not live entirely on the bird, for after they have engorged themselves they leave the chickens and hide in the cracks and crevices of the houses; for which reason a lathed and plastered house is the best, as it affords no hiding place for the parasites. Where this is not to be obtained, the next best thing must be used and the efforts against the parasites increased.

Of the blood-sucking parasites, probably none are so harmful as the *Argas americanus*, more commonly known as the chicken tick. It is an inhabitant of tropical America and is gradually extending northward. At the present time it is reported from various parts of Texas as causing considerable loss to poultry raisers of that State.

It is usually about a quarter of an inch long, but the specimen from which the colored plate was made was about three-eighths of an inch long. As a rule, the parasites are very flat, unless they have recently fed; in the latter event they assume a more rounded form. It will be noticed that the head of the animal is entirely covered by the body. A hand lens or an examination of the colored plate will show the back of the tick to be covered with small pits which have an elevated margin, and have a tendency to a symmetrical arrangement, but very often a large pit on one side is represented by two or more small ones on the other. The adults have four pairs of legs, but the young forms have only three, as shown in figs. 16 and 17.

The parasite was first described by Packard in the Sixth Annual Report of the United States Geological Survey of the Territories for 1872. When not engorged with blood they are very flat, which enables them to creep into very small cracks in boards and walls, a fact which makes them very difficult to reach and emphasizes the necessity of very thorough application of whatever means is adopted for



FIG. 22.—*Argas americanus*. Lateral view, first leg.

their eradication. They are nocturnal in their habits and are capable of living a long time without nourishment.

Of the remedies which have been used against the external parasites of chickens, none have proved so effectual as lime, alone or in combination with other agents, such as carbolic acid, sulphur, or corrosive sublimate. The method of making whitewash is too well known to need description; it may be applied hot or cold, but its efficacy is increased by its being applied hot. A good carbolic acid and lime mixture may be made by mixing $1\frac{1}{2}$ pounds of lime and one-quarter pound 100 per cent straw-colored carbolic acid to each gallon of water. Corrosive sublimate is sometimes used in place of carbolic acid but, on account of its poisonous properties, it is not to be recommended. The various lime-wash mixtures are usually applied with a brush, but where the area to be covered is very large it may be used with a force pump. Whichever method is adopted, care must be taken to fill all the cracks and crevices of the houses. As the pests against which the treatment is directed have a habit of falling to the floor when disturbed, the floor also must be saturated with the mixture; where the floor is a wooden one it should be scrubbed with the wash. This treatment should be repeated every week when the houses are old and afford good hiding places for the parasites, especially as the *Argas americanus*, during its early stages, lives entirely upon the chickens. If whitewashing is neglected the young ticks upon leaving the birds to live in the woodwork will form new colonies. Dipping has been suggested as a means of ridding chickens of external parasites, but this method of treatment has so often been followed by unfavorable results that the writer hesitates to recommend it.

MISCELLANEOUS INFORMATION.

Hog cholera and swine plague investigations in Iowa.—In the absence of a full report, which can not be given at this time, Dr. E. A. de Schweinitz, Chief of Biochemic Division, has deemed advisable to give here a preliminary report upon the experiments in the treatment of hog cholera and swine plague in the counties of Mills, Montgomery, Page, and Fremont, in Iowa, from April 15 to December 1, 1899.

The field work in the treatment of swine diseases during the year 1899 was carried out in Iowa on a somewhat more extensive scale than heretofore. The local general supervision of the work in Iowa was in the hands of Dr. McBirney, under explicit instructions from this office. Dr. W. B. Niles was placed in direct charge of Fremont County, Dr. Day of Page County, Dr. Adams of Mills County, and Mr. H. B. Waldron of Montgomery County. These gentlemen received instructions to endeavor to control the disease so far as possible in the counties named by the use of serum and proper sanitary precautions. The farmers in the various counties were requested to report to the inspectors, through the field men of the Bureau who were located in each county, any outbreaks of disease, and were encouraged to cooperate with the Bureau inspectors in keeping these outbreaks checked. The number of outbreaks and the number of herds treated in the different counties varied slightly and the virulence of the disease in the different counties also varied. Altogether about 21,000 animals were treated during the season. The serum used for this treatment was prepared in general, as indicated in Bulletin No. 23 of this Bureau, at the Experiment Station of the Bureau of Animal Industry in Washington, under joint supervision of Dr. Schroeder, director of the experiment station, and by Dr. de Schweinitz.

Cultures and blood slides were taken from all treated herds and forwarded to the Bureau laboratory for further investigation. As was to be expected, some of these cultures did not develop, but in a fair proportion of them the results were positive, and the presence of either hog cholera or swine plague or both was demonstrated. The specimens of blood were also carefully tested for the purpose of seeing to what extent the agglutination test could be used for diagnosing disease in the field. A detailed report of this work will be published later. The results in some cases were very satisfactory; in others, inconclusive or occasionally misleading.

Of the total number of animals treated, about 70.5 per cent sur-

vived. During the years 1896-1899 in nontreated herds, according to the statistics collected in the field by Dr. McBirney, the percentage of animals that survived was about 31. These results agree in general with what has heretofore been written in regard to the work, namely, that apparently by the serum treatment the percentage of animals saved is equal to the percentage of animals lost when the serum treatment is not used. During the year 1899 there were about 243,000 swine in the four counties where the Bureau inspectors were at work. Had all of these animals been treated and the proportion saved been the same as in the 21,000 animals inoculated, the cash value of the animals saved would have amounted to about \$474,000 in these four counties alone. This sum is very large as compared with the comparatively small amount spent in preparing the serum and treating the animals in the field. In Page County work had been done on a small scale in treating animals in 1897 and 1898. In 1899 herds were treated on three farms where the animals had been inoculated the year before. In these cases the animals that died were the offspring of nontreated herds. Those that recovered were the offspring of treated herds. This is a point worthy of special note.

Some of the outbreaks of disease which were encountered by the Bureau inspectors were of a more virulent character than any with which they had had to deal in years past. In addition, the losses from disease appeared to be greater in Page and Fremont counties than in Montgomery and Mills counties. For these reasons it was decided to confine the work to two counties during the season of 1900, and give more special and careful attention to the individual outbreaks. The Bureau will publish later a detailed report of the individual herds treated in each county and the results obtained, the character of the serum used for treatment, the manner of producing and preparing the serum, and as complete a report as possible, with other matters of interest in connection with the work.

While the serum treatment is not yet perfect, it has given far better results than any other mode of treatment of these diseases of animals ever suggested. The enormous field which would have to be supplied with serum and the mutual advantages which would accrue to manufacturers and farmers are very apparent.

A correction.—There was published in the Fifteenth Annual Report of the Bureau of Animal Industry an article on the cattle tick and tuberculosis in New South Wales which was forwarded to the Bureau by one of its inspectors. The article purports to be based upon an interview with a Mr. Gee, who spoke of the prevalence of the cattle ticks and the use of tuberculous cattle for meat. The Government officials of New South Wales deny the truth of the statements in the article, and the information furnished by them shows that an injustice has inadvertently been done to that colony. The inspector of the

Bureau evidently reported New South Wales by mistake for some other colony or used Mr. Gee's name for some other person. There seems to be no other explanation. Hon. George W. Bell, United States consul at Sydney, writes as follows concerning this matter:

I know Mr. Alban Gee, the person quoted in the article, well. He is not only a very honorable and very able business man, but he has the reputation of being a very discreet man also; and as the statements attributed to him are on so many points palpably erroneous, the article to me is inexplicable on any hypothesis except by a possible confusion of names, which might arise during a multiplicity of interviews.

Mr. Bell further states that up to the present time there has never been any cattle ticks or tick fever in the colony of New South Wales, and that constant vigilance is being exercised to prevent the introduction of the tick from Queensland. Because of these facts this correction is gladly made.

American thoroughbred horses in England.—Dr. W. H. Wray, inspector of the Bureau of Animal Industry for Great Britain, forwards the information given herewith regarding the sale of American thoroughbred horses in England:

The first lot of thoroughbred yearlings landed at this port were bred in California by Mr. James B. Haggin. They arrived June 28, 1899, and were placed on sale July 11. Forty-two colts were offered and readily found purchasers. The best price obtained was in the case of an exceedingly handsome Goldfinch colt (*Fleurette*), a mare by *Glenelg*, which, after spirited bidding, was bought by Mr. P. Gilpin for \$9,250. At this sale about one-half of the consignment was disposed of, the total amount realized being \$25,375, or an average of about \$600.

On the following day the second lot, the property of the same exporter, was sold. These colts, 43 in number, were quickly bought. The total amount received for the lot was \$26,000, or an average, as in the case of the former lot, of \$600. The total sum realized for the two lots, making a total of 85 head, was \$51,250, a sum which it would seem would tempt more breeders of this class of horses to follow the venture begun by Mr. Haggin.

Among the animals submitted at the second sale were 12 yearlings, also American bred, and sired principally by the Derby winner *Iroquois*. The consignment brought \$7,020, an average of \$585. Below are quoted the average prices brought by these 12 colts and also prices brought by some of Mr. Haggin's lot:

	Sire.	Dam.	Purchaser.	Price.
B. f.	Great Tom	Happy Girl	Captain Machell	\$500
Ch. f.	Iroquois	Taffeta	C. H. Seton	175
Br. f.	Iroquois	The Maid	F. W. Day	150
Ch. f.	Iroquois	La Danseuse	C. H. Seton	250

Sire.	Dam.	Purchaser.	Price.
Irquois	Gipsy	Lord Penrhyn.....	\$1,000
Great Tom.....	Guildcan.....	Lord Penrhyn.....	375
Hindoo.....	Jacquet.....	P. F. Gilpin.....	450
Irquois	Wanda.....	C. H. Seton.....	1,050
Clarendon.....	Nelly Van.....	W. T. Robinson.....	550
Irquois.....	Trade Wind.....	Mr. Melly.....	450
Irquois.....	Laughing Water.....	Captain Greville.....	350
Irquois.....	Fairy.....	Mr. Patton.....	1,100

[illegible]

Mississippi and International Exposition 1892-1894. **Thomas**
W. Higginson. Boston: Houghton, Mifflin, 1892. 128 pp. \$1.00.

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	Sire.	Dam.	Purchaser.	Price.
Ch. f.	Iroquois	Gipsy	Lord Penrhyn	\$1,000
Ch. f.	Great Tom	Guldean	Lord Penrhyn	355
B. f.	Hindoo	Jaconet	P. P. Gilpin	60
Ch. f.	Iroquois	Wanda	C. H. Seton	1,600
Ch. f.	Clarendon	Nelly Van	W. T. Robinson	550
B. f.	Iroquois	Trade Wind	Mr. Melly	450
Ch. f.	Iroquois	Laughing Water	Captain Greville	350
Ch. f.	Iroquois	Fairy	Mr. Patton	1,100

The following are the yearlings from Mr. Haggin's lot:

	Sire.	Dam.	Purchaser.	Price.
B. or br. c.	Sir Modred	Mary Adelia	Lort Phillips	875
B. c.	Goldfinch	Millie	M. Griffiths	16
Ch. c.	Star Ruby	Misfortune	M. Griffiths	20
Br. c.	Artillery	Miss Clay	P. P. Gilpin	90
B. c.	Juvenal	Miss Maud	Lort Phillips	35
B. f.	Candlemas	Miss Motley	F. Brough	20
Ch. f.	Golden Garter	Molly Walton	P. P. Gilpin	150
B. f.	Order	Mottle	M. Griffiths	50
Ch. f.	Golden Garter	Nana	N. H. Walker	3,000
B. c.	Goldfinch	Ortawin	P. P. Gilpin	1,150
Br. c.	Watercress	Pansy	T. S. Jay	3,500
Ch. c.	Watercress	Parthenia	P. P. Gilpin	1,300
Ch. c.	Golden Garter	Pink Cottage	Major Edwards	50
B. c.	Star Ruby	Preciosa	Lord W. Beresford	40
B. or br. c.	Order	Probability	Mr. Cuthbert	50
Ch. c.	Sir Modred	Queenfisher	Lord Penrhyn	65
B. c.	Fitz James	Queen's Taste	Mr. Cadman	25
B. c.	Goldfinch	Reclaire	Lord W. Beresford	1,000
Ch. f.	Star Ruby	Rehan	T. Jennings	70
Ch. f.	Goldfinch	Repressa	E. C. Clayton	30
Ch. f.	Sir Modred	Rosemary	T. Leader	75
Ch. c.	Kismet	Royal Purple	F. Brough	15
B. f.	Star Ruby	Salvora	Sir R. W. Griffith	1,500
Br. or bk. c.	St. Andrew	Samoa	W. H. Manser	45
Ch. c.	Goldfinch	Silence	Lord Cadogan	2,650
B. c.	St. Andrew	Sister Warwick	Lort Phillips	60
B. c.	Golden Dawn	Sozodont	Mr. Wright	15
Ch. c.	Orvas	Jellie Doe	Lord W. Beresford	55
B. c.	Candlemas	The Truant	G. Blackwell	15
B. f.	Sir Modred	Trinket	Major Edwards	10
Ch. c.	Bassetlaw	Vice Versa	Mr. Hanbury	30
B. c.	Goldfinch	Waitaway	Mr. Lacey	40
B. c.	Watercress	Zealandia	C. Archer	25
Ch. c.	Bassetlaw	Zuleika	C. Waugh	70

These prices are taken indiscriminately from the return sales and will serve to give a general idea of the venture.

Trans-Mississippi and International Exposition.—*Inspection of meat.*—The Bureau of Animal Industry made an exhibit at the Trans-Mississippi and International Exposition, held at Omaha from June 1 to

ber 1, 1898. The microscopic meat inspection system was illustrated by a practical demonstration of the manner in which it is conducted at the various packing centers in the United States. Four assistant microscopists were always in attendance and daily engaged in making examinations of pork samples furnished by the packing houses of South Omaha. On one table was shown a microscope with specimens of pork infected with trichinæ for inspection of visitors. A microscopist was designated to explain the preparation under the microscope and tell how the work was performed.

Dipping vats.—Several models of vats in which sheep are dipped to free them of the scab were shown. One of them consisted of a circular yard and vat attached, being a model of a form used in Australia and is especially adapted to handling large flocks containing several thousand sheep. Smaller vats of different construction were also exhibited.

By courtesy of the Fort Worth Stock Yards Company, a model of a dipping vat and yarding pens for dipping cattle to free them from the tick was shown.

Dairy exhibit.—The exhibit of the Dairy Division consisted mainly of an object lesson in the composition of milk and its products. A gallon of milk, a tub of butter, and a small cheese were shown, with the component parts of each, being displayed in sets of glass jars. Each set comprised the water, fat, casein, sugar, and mineral matters obtained in either the milk, the butter, or the cheese. Cream, skim milk, buttermilk, and condensed milk were treated in the same manner. Attractive samples of the by-products—such as sugar of milk in different forms, dried casein, and beverages made from whey—were exhibited. There was also shown a collection of packages in which butter is marketed in various foreign countries as well as our own.

Gape disease illustrated.—An exhibit of chickens affected with gape disease showed the characteristic symptoms. Alcoholic specimens in the trachea and drawings of the parasites were shown in the same connection.

Pathological specimens, etc.—Numerous pathological specimens of diseased organs in alcohol were exhibited, illustrating the lesions found in animals affected with various diseases. Among them were tuberculosis, Texas fever, and actinomycosis, and tuberculosis, hog cholera, and swine plague. In addition there were shown in hermetically sealed glass tubes several species of bacteria which are pathogenic for the lower animals. These bacteria showed the characteristic growth of the colonies, their color, and their general appearance.

There were models of horses' feet with various kinds of horseshoes, pathological specimens of diseases resulting from improper shoeing, and also models of diseased organs as seen in animals affected with

certain infectious diseases, being lungs of cattle affected with contagious pleuropneumonia, the nasal septum of a horse affected with glanders, and several organs of cattle affected with rinderpest.

Toxines, antitoxines, etc.—Several toxines and antitoxines which were prepared in the Biochemic Division of the Bureau, with specimens of mallein for the diagnosis of glanders in horses and tuberculin for the diagnosis of tuberculosis in cattle, were on exhibition. A quantity of blackleg vaccine manufactured in the Pathological Division was also shown, as well as a set of the instruments used for injecting it into the cattle.

Cattle transportation and quarantine station.—Photographs illustrating the transportation of horses and cattle by ocean steamers from the United States to foreign countries and the manner in which they are received and sold in those countries were on exhibition. This collection included a photograph of the animal quarantine station of this Department for the port of New York, located at Garfield, N. J., where cattle, sheep, and hogs which are imported from other countries are held in quarantine in accordance with regulations of the Department.

Texas fever line.—The Texas fever district, or that portion of the United States which is permanently infected with that disease, was shown by a colored map with a line from the west coast to the east coast of the United States to represent the district from which no cattle may be transported during nearly nine months of the year, except for immediate slaughter and under the regulations of the Department of Agriculture.

Contagious pleuropneumonia proclamation.—A framed copy of the proclamation which was issued by the late Hon. J. M. Rusk, ex-Secretary of Agriculture, on September 26, 1892, declaring the United States free from the contagious pleuropneumonia of cattle, occupied a conspicuous place. Since that date no case of the disease has appeared in this country.

Experiments with lime-and-sulphur dip.—Mr. W. R. Southey, of Varkenskop, the well-known breeder of Tasmanian sheep, has recently made some interesting experiments with the lime-and-sulphur dip, in order to ascertain if the fleece was in any way injured by the effect of the dipping.

Four samples of wool taken from the sheep experimented on were sent to Mr. H. B. Christian, of Port Elizabeth, who placed these samples in the hands of two of the best local wool experts, Messrs. John McIlwraith and Thomas Smerdon.

The wool, together with the reports of the experts, are at present in my possession, and I have much pleasure in complying with Mr. Southey's request for publication of the latter in the Cape of Good Hope Journal.

I may add that the wool has been taken from Tasmanian sheep, the luster, elasticity, and strength appearing perfect. The thanks of all farmers who desire to see scab eradicated from the country are due to Mr. Southey for his action in this matter.

ALLEN G. DAVISON,
Chief Inspector of Sheep.

FOUR SAMPLES WOOL DIPPED IN LIME AND SULPHUR.

No. 1.—Ewes' wool, nine months' growth, dipped in lime and sulphur, the whole of the mixture emptied into tank, but being allowed to settle, and only liquid used.

Report on sample of wool No. 1.

No. 1.—Stated to be ewes' of nine months' growth; excellent length for only nine months' growth. Quality, luster, elasticity, and strength of staple perfect. A faint trace of dip.

JOHN MCILWRAITH.

PORT ELIZABETH, October 2, 1899.

Report on sample of wool No. 1.

No. 1.—Said to be nine months' growth. Very sound, evenly grown, good character, with luster; combing.

THOS. SMERDON.

PORT ELIZABETH, October 10, 1899.

No. 2.—Twelve months', hoggets'; dipped in lime and sulphur; five and six months' growth; same mixture as above; two dippings.

No. 2.—Twelve months', hoggets' or lambs'; beautiful quality; quite equal to Australian; length, luster, elasticity, and strength of staple perfect. Has all the qualities for producing a superior Bradford top. Faint trace of dip.

JOHN MCILWRAITH.

PORT ELIZABETH, October 2, 1899.

No. 2.—Hoggets'; very sound, with quality, superior luster, full combing.

THOS. SMERDON.

PORT ELIZABETH, October 10, 1899.

No. 3.—Hamel wool, dipped in lime and sulphur; four months' growth; two dippings—5 pounds lime to 20 pounds sulphur; dip allowed to settle and only liquid used.

No. 3.—Hamel, very deep grown; grand combing wool; not extra fine quality; beautiful luster, sound staple. Faint trace of dip.

JOHN MCILWRAITH.

PORT ELIZABETH, October 2, 1899.

No. 3.—Hamel, very sound, beautifully grown, superior 12 months, combing, with luster.

THOS. SMERDON.

PORT ELIZABETH, October 10, 1899.

No. 4.—Ewes' wool, nine months' growth, from ewes rearing lambs, 12 years old, running on lucern, but dipped.

No. 4.—Stated to be from 12-year-old ewes of nine months' growth. Splendid length for nine months' growth. Beautiful quality, luster. Elastic and sound in staple, but rather yolky. Sheep evidently too well fed. No trace of dip.

JOHN MCILWRAITH.

PORT ELIZABETH, October 2, 1899.

No. 4.—Ewes, very fine quality, wonderfully sound considering its being shorn from sheep said to be 12 years old, with 5 months' lambs at breast.

THOS. SMERDON.

PORT ELIZABETH, October 10, 1899.

The farmer owning the sheep which produced these samples has every reason to be proud of his flocks, and if we had the farms stocked with flocks of similar strain, Cape wools would rank higher than they do to-day.

The trace of dip in samples Nos. 1-3 is so faint that it is difficult to say what dip it is; smells like lime and sulphur, but there has been no injury done either to the fleece or color of the wool by the dip.

We should say that the wool of No. 2 sample was longer grown when the sheep were dipped than that of Nos. 1 and 3.

JOHN McILWRAITH.

PORT ELIZABETH, October 2, 1899.

All the above shows that the greatest care must have been taken with the flock represented, and the grower may really be proud in possessing such excellent stock. It is said that samples Nos. 1-3 have been dipped. It is, however, hardly possible to trace it, but if such be the case, the result of such dipping, judging from their excellent luster, soundness of staple, and general appearance, must surely prove the efficacy of such dip. It is also said that the stock represented by sample No. 4 has been grazed on lucern, which fact speaks very highly for the suitability of this article of food for sheep.

THOS. SMERDON.

PORT ELIZABETH, October 10, 1899.

—(*From Agricultural Journal, Cape Town, Cape of Good Hope, December 21, 1899.*)

Disinfection of hides of cattle shipped to the United States.—

TREASURY DEPARTMENT,

OFFICE OF THE SECRETARY,

Washington, D. C., January 23, 1899.

To Collectors of Customs and others:

Department's circular of November 22, 1895 (Synopsis 16557), provides for the disinfection of hides of neat cattle, other than those which have been arsenic cured or dry salted, when imported from the countries of Europe, Asia, Africa, Australia, and South America, and further directs that hides of neat cattle, other than dry salted or arsenic cured, the product of the countries above named, will require disinfection as above whenever they shall be shipped via the ports of any other country; and that hides, other than dry salted or arsenic cured, the product of any country not named above, if transshipped and actually landed at ports in any of the countries named, will require disinfection.

It having been represented to the Department that great injury results to moist hides by the process of disinfection prescribed by said circular, and as hides stripped from cattle at abattoirs are presumably in a condition not requiring disinfection, it is hereby directed that, so far as the countries of Norway, Sweden, and Great Britain are concerned, entry may hereafter be allowed of moist hides imported direct therefrom without disinfection, provided the invoice shall contain the

declaration of the shipper that the hides are the product of such countries and were stripped from cattle in those countries, and that a certificate shall also be produced from the official veterinarian to the effect that the hides were taken from perfectly healthy cattle.

W. B. HOWELL,
Assistant Secretary.

Injury to hides by branding.—Mr. William R. Fitch, United States Minister at Montevideo, transmits to this Department, through the Department of State, some information regarding the injury sustained by hides in the branding of cattle which will be of special interest to the stock raisers of the West. The president of the French Chamber of Commerce of Montevideo transmitted to the Minister of Agriculture of Uruguay the following communication:

I have the honor to send to your excellency, in the name of the French Chamber of Commerce, over which I preside, a translated copy of a note from the Chamber of Commerce of Rouen to the Minister of Foreign Affairs of France, respecting fire brands on hides from the River Plata. The French Chamber of Commerce believe it their duty to call the attention of your excellency to so interesting a question, and one of so much importance. As your excellency will note, the statistical data contained in this note gives for 1897-98 a proportion of 35 per cent of hides having no marks [brands] and 12 per cent having three or more marks. Each hide of the first class suffers a depreciation of 3 to 4 francs, and each hide of the second class from 5 to 8 francs. Leaving out the heifer and calf hides, dry and salted, there were exported in the year 1895, according to official statistics—

Salted hides	871, 816
Dry hides	663, 828
Total	1, 535, 644

According to statistics furnished by the principal tanners of Europe the hides received in 1897-98 were in numbers and marking as follows:

Hides with one mark	813, 891
Hides with two marks	537, 476
Hides with three or more marks	184, 277
Total	1, 535, 644

Admitting, for a basis of calculation, the smaller depreciation indicated by the Chamber of Commerce of Rouen—that is, 3 francs for each hide having two marks and 5 francs for each hide having three or more marks—the following statement shows the enormous annual loss to the cattle industry which results:

	Francs.
537,476 hides, at 3 francs	1, 612, 428
184,277 hides, at 5 francs	921, 385
Total	2, 533, 813

In the presence of these figures the French Chamber of Commerce believe it unnecessary to discuss the benefits that would accrue to the Republic in the enforcement of a law similar to the one existing in Australia respecting the marking of cattle. In the opinion of the chamber it would be of easy application, and result beneficially within a very few years after its enactment.

a In round numbers, \$472,700 in gold.

According to the statistics mentioned by the Chamber of Rouen, it is seen that every year the number of hides with two, three, or more marks is increasing, and the progress of the increase is great. In 1893-94 the number of hides with two marks was 17 per cent of the whole number, and in 1897-98 the number is increased to 35 per cent—more than double. The hides with three or more marks reached 3 per cent in 1893-94 and 12 per cent in 1897-98. The Chamber of Rouen has forgotten to indicate the depreciation of a hide having one firebrand, but this does not prevent us from establishing with exactness the losses which the present marks cause to the hide production. It is believed that the depreciation of a hide having one firebrand is 1.50 francs.

According to official statistics in the year 1897 these were reported—

	Number.
Salted hides	815,897
Dry hides	727,201
Total	1,543,098

Taking the above figures as a basis for an estimate for 1897-98, we have the following: 817,842 hides, or 53 per cent, with one mark; 540,081 hides, or 35 per cent, with two marks; 185,172 hides, or 12 per cent, with three or more marks.

The loss to the country at 1.50 francs for the second class and 6.50 francs for the third class was—

	Number.	Value.
At 1.50 francs	817,842	1,226,763
At 3.50 francs	540,081	1,890,284
At 6.50 francs	185,172	1,203,614
Total	1,543,095	4,320,661

This amount is about \$800,125 in gold. It shows the enormous loss suffered by the country in consequence of the present system of branding. It having been shown that the use of fire brands is prejudicial to the cattle industry, a regulation should be adopted and enforced, as the chamber of Rouen advises. The question should not be allowed to sleep in official desks. Voices more influential than mine should sustain the initiative taken by the French chamber, because it tends to benefit the country by obliterating vices in the system of marking, easy to destroy, if, as I expect, the minister of agriculture takes up the question and has it investigated, either through the Rural Association of Uruguay or through a special committee, as was done in Argentina and also in Australia in 1893.

Successful treatment of lumpy jaw.—Mr. J. A. Moore, a stock raiser of Buffalo, Wyo., under date of February 23, 1899, sends to the Bureau the following communication regarding the successful treatment of a cow for lumpy jaw:

I wish to make a report in regard to a lumpy-jaw cow that I wrote to you about nearly a year ago. She was a 3-year-old registered Hereford, but wild, having been range raised. She dropped her calf May 19, 1898. I gave the calf to another cow and began treatment with iodide of potassium as you directed. Of course, I had to throw her to give the medicine, and while she was down I poured tincture of iodine on the tumor, which sloughed off in flakes sometimes nearly as big as my hand. About the last of June I dislocated one of her hips while throwing her and I quit doctoring her for about three weeks.

When the accident happened the sore was nearly dry, and free from matterated flesh, but by the time her leg got well the sore was nearly as bad as at first. I then doctored her until September 1, and she was so poor in flesh that I thought I had better kill her; but the sore entirely dried up and she was allowed to live. She has run with my other cattle and has had only alfalfa hay in stormy weather, and the rest of the time the pasture. She is gaining flesh right along, and now the tumor seems to be dry and hard. When I begun doctoring her the raw tumor measured $20\frac{1}{2}$ inches in circumference directly under her jaw. The swelling reached from the mouth to the throat and extended up to the eyes on both sides. The tumor now measures 13 inches in circumference.

Cattle notes of southwestern Texas.—On the ranges in the southern and southwestern part of Texas, especially those that have been overstocked for many years, grass is exceedingly scarce. Indeed, on many ranches heretofore considered good grazing land little or no grass now remains. It has been trampled over so much that the roots have been destroyed. The recent rains were unable to revive it. Notwithstanding this condition, nearly all of the cattle are in very good condition. Their principal food is cactus, with its product, the prickly pear, and occasionally mesquite beans.

On a recent trip to Roma, Tex., I was compelled to travel 80 miles by stage. Along this route hundreds of yoke of oxen travel every day, this being the only route by which freight can be transported from the railroad to Rio Grande City and Roma. The only food given these oxen is cactus, and it serves in the double capacity of food and water. During a drought there are few places where water can be obtained. The method of preparing the cactus so that the animals can eat it without lacerating their mouths is to first scorch it to remove the thorns and then it is cut close to the ground. The cattle eat it with apparent relish. A gentleman who lives in Roma informs me that if it were not for the cactus he would have lost at least 1,000 head of cattle last winter. He also stated that he purchased two carloads of bulls in San Antonio last fall and drove them to his ranch. There being no grass he fed them on cactus and cottonseed meal and hulls. After being fed all winter, they were in the finest possible condition when he turned them out in the spring.

During the past year vast numbers of cattle have been driven in from the border counties along the Rio Grande River. Most of them have gone to the Indian Territory. If no cattle were taken into southwest Texas for a few years it would be most beneficial for all parties concerned. The ranges which have been depleted for years would have a chance to regain their old-time condition; and by careful and judicious management the ranges, which are now in almost a worthless state, would be able to produce as fine a grade of cattle as there is anywhere. Wells can be sunk in most places, and a little

time spent in building ditches will enable water to be secured and kept for a time of drought.

I have been surprised on my trips to southwestern Texas to find so few ticks (*Boophilus bovis*) on the cattle. In passing through ranches I have always gotten as close as possible to the cattle and in most instances I have found them having but few ticks. It was observed that the females do not seem to remain on the cattle until they mature, for in a larger number of cases the ticks were only half grown. Not long ago, while in Zapata County, I was passing a corral in which there was quite a large herd of cattle. I examined them for ten minutes, but was unable to discover any ticks.

The extraordinary cold winter of 1898-99 was very destructive to ticks. Perhaps two or three winters like the last one would so reduce their number in the country that by the use of mechanical means there would be a probability of exterminating this pest forever. It may be that the cold of last winter also deprived the tick of some of its virulency.

There is at this time a strong inclination to import cattle from Mexico. The prices over there are very much lower than in the United States, and all the cattle that I have seen are in pretty good condition.

JOHN A. KIERNAN,

Assistant Inspector, Bureau of Animal Industry,

SAN ANTONIO, TEX., *July 22, 1899.*

A report concerning the cattle of Porto Rico.—

SAN JUAN, PORTO RICO, *May 29, 1899.*

SIR: Pursuant to authorization from the honorable the Secretary of Agriculture and your instructions of March 27, 1899, to proceed to the island of Porto Rico for the purpose of making investigation concerning the existence of Texas fever infection and to note incidental observations of interest to the Bureau of Animal Industry, the following report is respectfully submitted:

On April 11 I arrived at San Juan, and since that date have visited practically all the cattle districts of the island of Porto Rico. From the most reliable information obtainable, I judge the number of cattle on the island to be 500,000, the majority of which are in the coast country, although there are small bunches and individual animals scattered throughout the mountainous interior. The predominant color is solid light yellow; some are black, others white and black, and but few roans and reds; many have dark muzzles, ear tips, and legs. The hair is short and glossy; some are almost devoid of hair on the belly and inside of the thighs. The horns of many are inclined to unusual elevation and the ears droop. The color, the round, clean-cut straight limbs of many of the young animals and their well-rounded bodies with elevated heads and spike horns close together remind one of the antelope of our Western plains. The cattle of this

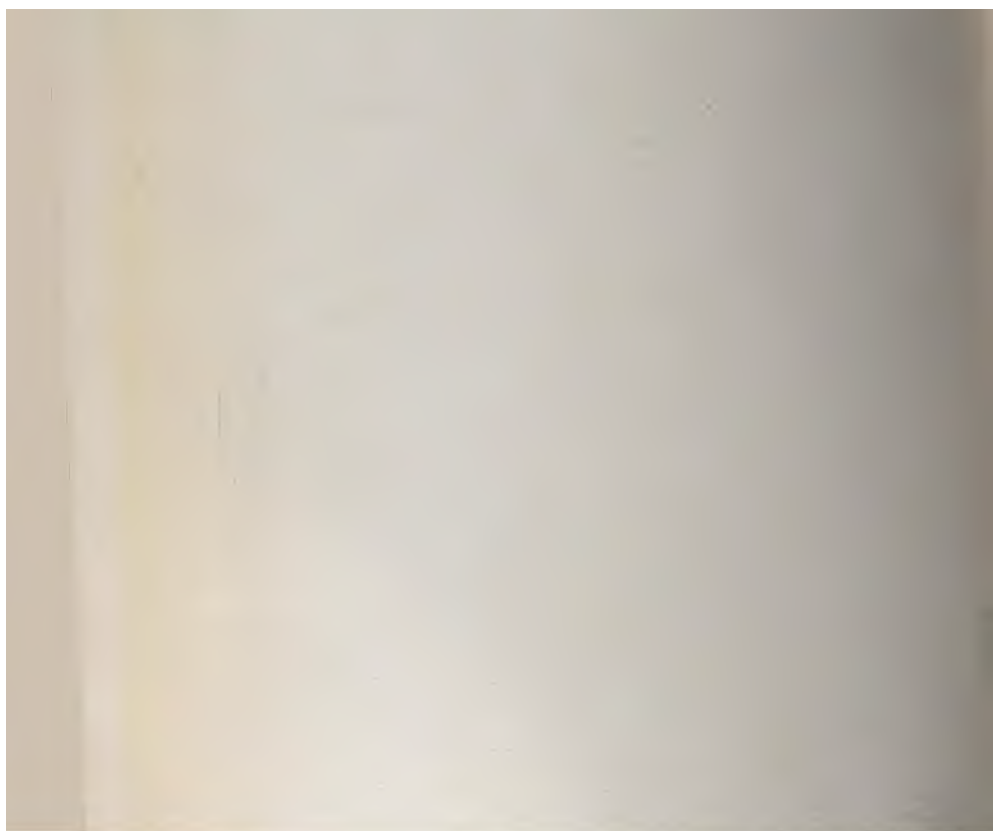


A NEAR VIEW OF PORTO RICAN STEERS.





GROUP OF PORTO RICAN CATTLE IN YARD.





PORTO RICAN CATTLE IN PASTURE.



island are usually in good flesh throughout the year. During April and May were seen numbers of four or five year old steers ready for export which averaged 950 pounds, and which had never received food other than that afforded by the native grass pastures. Older oxen far exceed the weight mentioned. They are all of the same general type, being descendants of the old Spanish stock with the infusion of African blood. The latest African importation was in the year 1834 and consisted of five Senegal bulls bought by Señor Casinus Laporte, of Ponce. It is said that two Swiss and four English cows were brought to this island in the year 1864, later data of which is unattainable. For at least during the past century the deleterious effects of inbreeding have obtained, and are decidedly in evidence in the cattle of the island.

Cattle are the universal burden carriers. They are hitched to immense two-wheeled carts by a crude yoke which rests on the poll and is lashed to the base of the horns. They haul all freight between the ports and the interior. Therefore, if the dangerous tick exists at all, the opportunity for the spread of infection is most favorable. The annual increase is 95 per cent of the sexually mature females; and, as the island is free from wolves, coyotes, and allied foes of young live stock, the small percentage of loss is confined to the usual accidents incident to birth and to a large spider, the bite of which occasionally results in death.

Porto Rican cattle as a rule are very tractable, being accustomed to grazing at the end of a rope or otherwise handled by attendants. On the east coast I have seen more than a hundred head on a small tract of land where the grass, similar to Johnson grass, was higher than their backs, and so thick that it was with difficulty that our saddle ponies could make their way when away from the beaten paths. Each animal was tied to a bunch of grass by means of a rope about 25 feet long made of bark. This circle of 50 feet in diameter would suffice for many days' full rations. At no time of year are the cattle housed; except in a single instance, where there was a mere shed for protection from the sun, I found no pretense for cow-barn building.

But little attention is given to the matter of improving the stock, either by the introduction of new blood or the selection of the best native individuals for breeding purposes. The steers have a staggy appearance, for it is the custom to allow all male animals to reach sexual maturity in the herd. In view of these facts there is no great wonder that the size of the cattle and the distribution of flesh on the animal frame do not approach the standard for beef breeds, or that the milk secretion is scanty. The ill effects of inbreeding and general injudicious handling must be in part counteracted by the natural favorable conditions of the island, which insure nutritious grasses and equable temperature throughout the year.

Judging from general appearance and from the fact that some 400 head of native cattle at the United States vaccine station, at Coama Baths, Porto Rico, were tested with tuberculin with but 1 per cent reacting, none of which were found upon post-mortem to be diseased, I conclude that there is but a small percentage of these cattle affected with tuberculous. The bacilli of tetanus and blackleg have a general distribution. Deaths from these diseases occur annually in different parts of the island. Minor surgical operations have been so frequently followed by tetanus that the use of the knife in castration has been discarded, and, as prevention against invasion by germs and annoyance by flies, a rather imperfect form of castration is accomplished, either by bruising the testicles or by rupturing the spermatic cord by torsion and tension without incising the skin.

From the reports of cattle owners it appears that exceptional conditions on this island produce annually a few well-marked cases of Texas fever. Ticks are the greatest enemies of these cattle. In all localities they were found infested with ticks, always apparently of the same species, numerous specimens of which were mailed to the Bureau of Animal Industry.¹ If it is proven that this tick is capable of transmitting Texas fever, there can be no doubt that all Porto Rico teems with the contagion of Texas fever throughout the entire year, and that no cattle could depart from or be brought into the island without contact with such contagion.

I desire to acknowledge in this report the valuable service rendered by Mr. Simon Moret, of Ponce, and the courtesies of the War Department extended through Dr. Maj. Azel Ames during this investigation.

Very respectfully,

RICE P. STEDDOM, *Inspector.*

Dr. D. E. SALMON,

Chief of Bureau of Animal Industry.

Texas cattle.—The breed of Texas cattle, which has until quite recent years figured in the development of the great Southwest, is fast becoming extinct. The Texas steer and the cowboy will soon be known in story only; they are both "passing." The cattle are vanishing before the onward movement of the blooded stock from the North and East. One of the most famous of the long-horn animals of recent years is Geronimo, whose picture is shown on Plate XX. He is said to be 36 years old, and his horns measure 9 feet 6 inches from tip to tip. The Texas Farm and Ranch, of Dallas, Tex., is to be credited with the enterprise of having this animal photographed, in order that a true likeness of so valuable a type of the breed may not be lost altogether. Plates XXI and XXII show a bunch of steers in stock yards. The horns, which are the most distinctive feature of this breed, are brought out very prominently.

¹ See report on these ticks on p. 23.

Some statistics of cattle and cattle products of the Argentine Republic.—The facts and figures given in the paragraphs below are from an article by Mr. François S. Jones, chargé d'affaires ad interim at Buenos Ayres, under date of August 24, 1899, and published in a recent consular report:

The census of May, 1895, the last that has been made in the Argentine Republic, fixes the number of cattle in the Argentine Republic at 21,701,526 head, of which 14,197,159 were native, or criollo, 4,678,348 mestizos (mixed breeds), 72,216 pure-bred stock, 1,800,799 milch cows of all kinds, and 953,004 oxen for labor. The total number is claimed not to have increased since then, but I have not been able to secure authoritative data on this point.

The prices of hides range from \$9 to \$10 per 105 pounds. Dry hides are dearer than salted ones. In the treating dry hides lose on the average 18 per cent in weight. In 1898, 23,173 tons of dry hides and 29,367 tons of salted hides were exported from the Argentine Republic at a valuation of \$6,887,596 and \$5,171,440, respectively, the export duty being 4 per cent.

The price of tallow averages \$4.50 to \$5 per 105 pounds. It is exported, as "sebo" and "grasa derretida" (melted tallow or suet), in not inconsiderable quantities to Belgium, Brazil, Spain, France, Italy, Portugal, and Great Britain. The total exports of this article amounted in 1895 to 40,588 tons and in 1896 to 34,143 tons, valued at \$3,807,751 and \$3,179,326, gold, respectively.

Tongues sell on the average for \$20, gold, per hundred. Although they constitute an important article of consumption in the Argentine Republic, they are also exported, both salted and canned. The chief foreign destinations for salted tongues were, in 1895, Brazil, Great Britain, Germany, Italy, and France; but in the year following that date a remarkable falling off in the export of this article occurred, and it has not since revived. In canned or preserved tongues a considerable export trade continues, amounting in 1895 to 1,574,568 pounds and in 1896 to 1,279,576 pounds, valued at \$157,455 and \$127,955, respectively. Frozen tongues are now also being exported.

Horn, bones, bone ash, dried blood, and sausage casings, although articles of export, are too inconsiderable in amount to require any detailed reference here. The export duty on horns, bones, and bone ash is 4 per cent.

The exportation of live stock began about ten years ago and proved at first a failure, financially, on account of only the criollo, or native, kind being shipped; but with the breeding and export of finer cattle this trade is proving remunerative. It has now reached a point where it pays better to breed a fine class of cattle for exportation alive than to raise an inferior kind for the saladero¹ industry.

The exports of live cattle to Europe and Brazil from January 1 to May 31 of this year amounted to 69,000 head, about 14,000 head more than the number exported for the same period in 1898.

While cattle in the province of Buenos Ayres have undergone little change with respect to quantity, and have improved in kind, on the other hand, in the provinces of Santa Fe, Corrientes, and Entre Rios, a large decrease in the number of cattle has taken place, and to such an extent in Entre Rios that the government of that province has been debating the passage of a bill providing for levying a tax of \$5, paper, for each cow killed under 7 years of age.

Decrease in Canadian-British cattle trade.—The British market for Canadian cattle has not been satisfactory this season (1898) to Canadian shippers, though freight rates and fodder have been cheaper.

¹ Salting establishments.

The total number of cattle shipped was 101,281 head, of which 5,719 were United States stock shipped in bond. The total number of cattle is 20,130 less than last season.

I have been informed that the average cost is \$5 per head lower, making a total value of \$5,570,455. Ocean freight, at an average of \$8.75 per head, amounts to \$886,208.75; while the railway charges were \$3.25 per head, or a total of \$329,163.25.

It is estimated the amount of hay used on ocean voyage during the season was 14,154 tons, at \$8 per ton, making a total of \$113,232. Of feed, 3,654 tons, at \$20 per ton, were also used, amounting to \$73,080. Fitting up the ships amounted to \$165,634; insurance, \$99,094; care at yards, \$49,524; loading fees, \$51,784; attendance, \$68,820; or a grand total expenditure for the season of \$7,406,995, showing a decrease of \$1,917,854, compared with 1897.

It is pointed out that, apart from the poor market, one of the reasons for the falling off in shipments was the fact that the United States buyers have purchased quite heavily in Canadian markets, the stock being shipped via American ports.

It also appears from official statistics that the sheep trade is in the same bad condition. The shipments for the season were 34,991 head, showing a decrease of 26,263, as compared with 1897, and a decrease of 45,680 from 1896. The value, at an average price of \$5 per head, amounted to \$174,955; ocean freight, \$34,991; insurance, \$87.47. This branch of the live stock trade has fallen away fully 75 per cent within the past three years.

The export of horses for the past season also shows a decrease of about 50 per cent, as compared with 1897. The total shipments for the season of 1898 amounted to 5,822 head, showing a decrease of 4,226, compared with 1897, and of 4,203 from 1896.—(*Gustave Beutelspacher, Commercial Agent, Moncton.*)

Shipments of Venezuelan cattle to Cuba.—Since my report of November 3, 1898, steamers have left this port loaded with 3,701 cattle for Cuban market. Messrs. Silveria & Co., Habana, Cuba, through their agents, Nadle & Roca, have closed another contract with responsible cattle owners in the state of Miranda, Venezuela, for 24,000 head of cattle, which makes the stock now ready for shipment about 36,000 head.

The cattle of this firm are to be delivered at a small station on the Caracas and Valencia Railway near Valencia, and will be shipped from there to this port via the Caracas and Valencia and Puerto Cabello and Valencia railways.

The house of A. Braschi & Sons has entered this Cuban cattle trade and will ship to Cienfuegos, Santiago de Cuba, and other ports in Cuba several cargoes of selected stock within the next thirty days. The senior of the firm of Braschi & Sons is consul for Italy at this

port, and the firm has branch houses in Barquisimeto and Valencia, which are directed by the principal house at this port.

I have been informed that the house of Boulton, owners of the Red D Line of American steamers, is contemplating taking a hand in this Cuban cattle trade if they can secure the necessary steamers, but can not at this writing give more information as to the extent of their operations.

I am glad to report that the way of loading the cattle into steamers by hoisting them with rope and pulley, the pulley hooked into a rope around the base of the horns of the animal, allowing the whole weight to be held up by the horns, has been abandoned. All the steamers now used in the cattle trade have ports large enough to allow of driving the cattle through them.

The first steamers sent to Cuba lost in transit from 10 to 38 head, and I think the cause of the death of the majority was the injuries they received through being loaded in the manner above described. Since the loading by hoisting was abandoned the loss of cattle in transit has been very small.—(*Luther T. Ellsworth, Consul at Puerto Cabello.*)

Trade of Liverpool with the United States.—The following paragraphs on meat and cattle, bacon and hams, and cheese are from a report by Mr. James Boyle, consul to Liverpool, and published in the Consular Report of March, 1899:

MEAT AND CATTLE.

The most noteworthy phase of the trade in American beef is the great increase in the importation of chilled meat. Until quite recently it has been considered that the meat of American cattle slaughtered here was far superior to chilled meat, but there is undoubtedly a great change in this regard, and many buyers and sellers claim that the American chilled beef is equal, if not superior, to the meat of American cattle slaughtered here. The chilled-meat trade is increasing enormously, and there is a growing conviction that in the course of a few years it will almost entirely take the place of American meat brought on the hoof. The meat of American cattle slaughtered here is put through a process of chilling, but owing to the inexperience of the English people and their lack of facilities the process is not as satisfactory as in the United States.

American meat is often sold as English; indeed the choice cuts of American beef are preferred by many of the large butchers to the best English cuts. Experts say that English cattle are depreciating in value and quality, one reason being that animals are now being slaughtered at 2 years old instead of 4 years as formerly. Not only is the trade in chilled beef increasing to vast dimensions, but there is a *large and increasing* trade in fresh chilled pork. It is a fact

not generally known here to those outside the trade that most of the pork pies, which are a staple article of food among the English working classes, are made from fresh chilled American pork.

Within the last few months there have been several experiments in shipments of chilled poultry from the United States. Poultry is very dear in England, and is of an inferior quality to American poultry. There is hardly any limit to the possibilities of the trade in American poultry if it can be brought over here in good condition.¹

American mutton is not making headway, largely because it is fattened too quickly. There is a large and increasing quantity of frozen beef and mutton being brought from Australia and New Zealand. While the quality of antipodean beef is not comparable to the American meat, these importations greatly affect the sale and price of the latter. The Canadians are also seeking a share in the chilled meat trade, and active competition is probable in the near future.

During the year ended December 31, 1897, there were imported into Liverpool from foreign countries 94,671 tons of beef, 36,259 tons of mutton, 279,390 head of cattle, and 229,125 head of sheep. No record is kept by the local authorities as to the ports from which the supplies are received, but it may be safely assumed that nearly all the fresh meat and the cattle and a large proportion of the sheep were imported from the United States.

BACON AND HAMS.

There is a good demand for American bacon and hams, and, provided they come mild and not too fat, there is every prospect of increasing sales. They should not be smoked. So long as the hogs are fed on Indian corn the bacon and hams will not give the same satisfaction as the bacon from Canada, where, I understand, peas and oats are used for food. Bacon that is the least salty will not suit the taste of the British public, therefore care has to be exercised in shipping mild hams and bacon so that the supply is not in excess of the demand, as they will not keep for any length of time. Up to the present there is not sufficient cold-storage accommodation in Liverpool; but this want is being provided for by a public company, and one of the large bacon importers is having such accommodations fitted up in his own warehouse.

CHEESE.

The fact that American cheese on this market is being displaced by Canadian is becoming more and more apparent. On inquiry from reliable sources, I am told that this is principally owing to the method of manufacture, which is spoken of here as being radically wrong; and, assuming that the American factory men generally wish to com-

¹ See pp. 321 and 333 for report on egg and poultry markets of England.

pete for the English trade, the sooner they set about altering the style of manufacture the better. It is stated by the trade that the manufacturers in the United States of what is known as the "quick-ripening" process cheese have in a great measure ruined the trade for American cheese. One of the reasons of the present deadlock here has been the fact that the summer make of these "quick-ripening" cheeses were sold at too high prices and went into the hands of the retailers, who have been unable to clear them promptly, and consequently they have "gone bad" on their hands, the result being that the dealers, or retailers, can not now push the trade for mild late-made cheese. The consensus of opinion is that it is a suicidal policy on the part of the factory men to allow cheese to be manufactured that will keep only for a short time. Cheeses so made, on arrival in England are so ripe as to necessitate immediate disposal; otherwise they are liable to get, if kept, first, strong in flavor, and afterwards almost putrid.

In an interview with one of the leading firms of cheese importers in Liverpool, I learned that years ago he took the cheese of certain special factories in the United States for years, week after week, with the knowledge that when the cheese arrived in England it would be as good as when shipped, and would keep a reasonable length of time in the hands of the retailers; but now, he says, this is all changed. I was shown some of these "quick-ripening" cheeses, and they were so soft that the least pressure of the finger made a mark, whereas the Canadian cheeses were firm and solid. The firm mentioned above, which has a house in New York, did not, until a few years ago, deal in Canadian cheese, preferring the American, which was of better quality and better made; but now it handles far more Canadian than American. This "quick-ripening" process further entails serious loss in weight to the importer from shrinkage in transit, even when promptly sold. From the same cause, cheese becomes "discolored and mottled," and "porous open made," and is difficult to sell. Lately, the price of American cheese has still further declined, not so much because of the market as that in most cases importers and dealers alike have lost confidence in the article. In Canada, the makers are educated and trained to manufacture a reliable article, and for years past the make could be depended upon to keep for any reasonable length of time. The Canadian Government, so the importers here state, recognizes the value of the product and affords every facility for the education and the training of young men for the manufacture of high-class cheese. Such cheese is bought on this market "unseen."

United States sausages in Gibraltar.—Consul Sprague writes from Gibraltar, December 16, 1898, that an Italian recently imported from New York sixty-nine *packages* of provisions, among them about 41 *hundredweight* of smoked sausages. After selling the sausages to

several grocers in this market, and while a small quantity was being offered at retail at the auction mart by one of the purchasers, the sanitary inspectors, with the approval of the medical officer, condemned the goods as unmerchantable; and immediately after the other parties who had purchased the remainder of the lot were required to forward to the sanitary board samples of the sausage in their possession, in order that they might be examined.

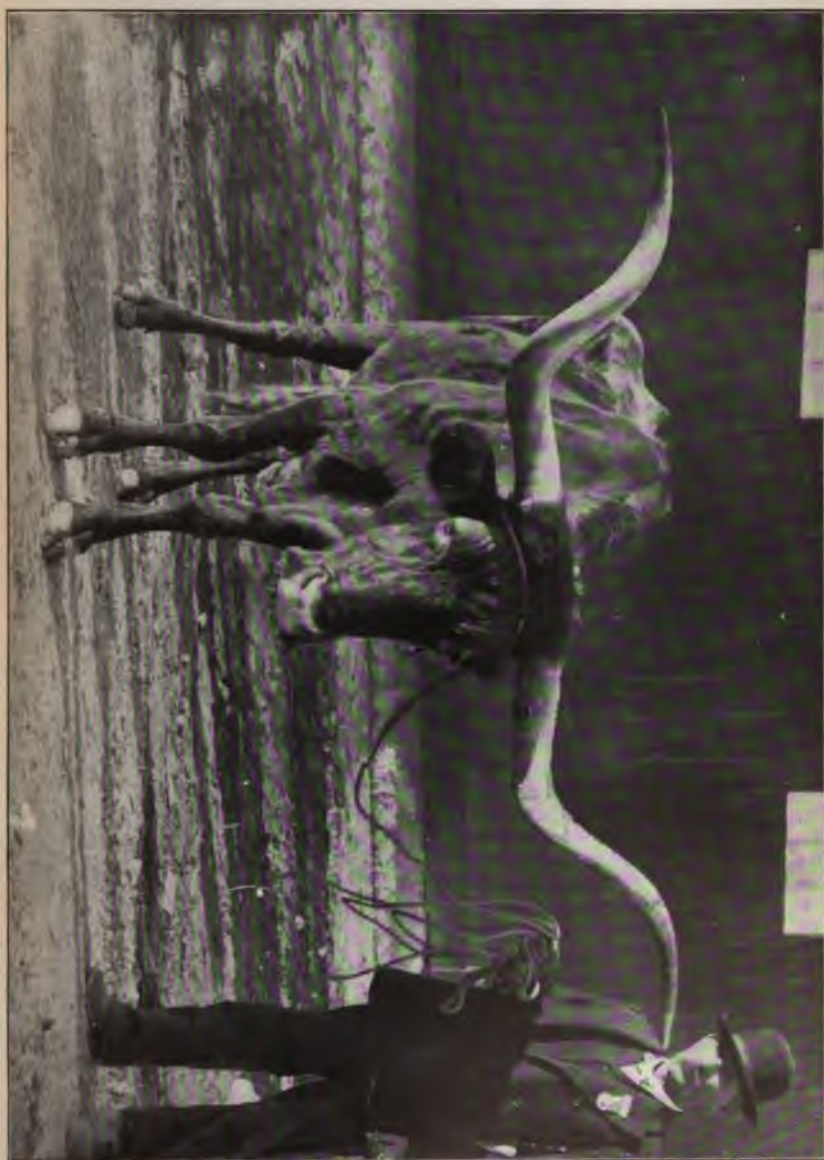
So convinced was the importer that the sausages in question were in a sound and merchantable condition that he called upon the consul in the hope that he might do something in his favor, since the sausages were bona fide American meat products. Mr. Sprague continues:

I called at the office of the sanitary commissioner, and as the sausages, after examination, seemed to me to be in a sound condition I pointed out the importance of a careful and impartial inspection before any other decided steps be taken in the matter. Soon after my departure a formal survey took place, in which duty a justice of the peace, and old-established English merchant, took part, and the result ended in favor of the importer, who was at once relieved from any further trouble and responsibility in the matter.

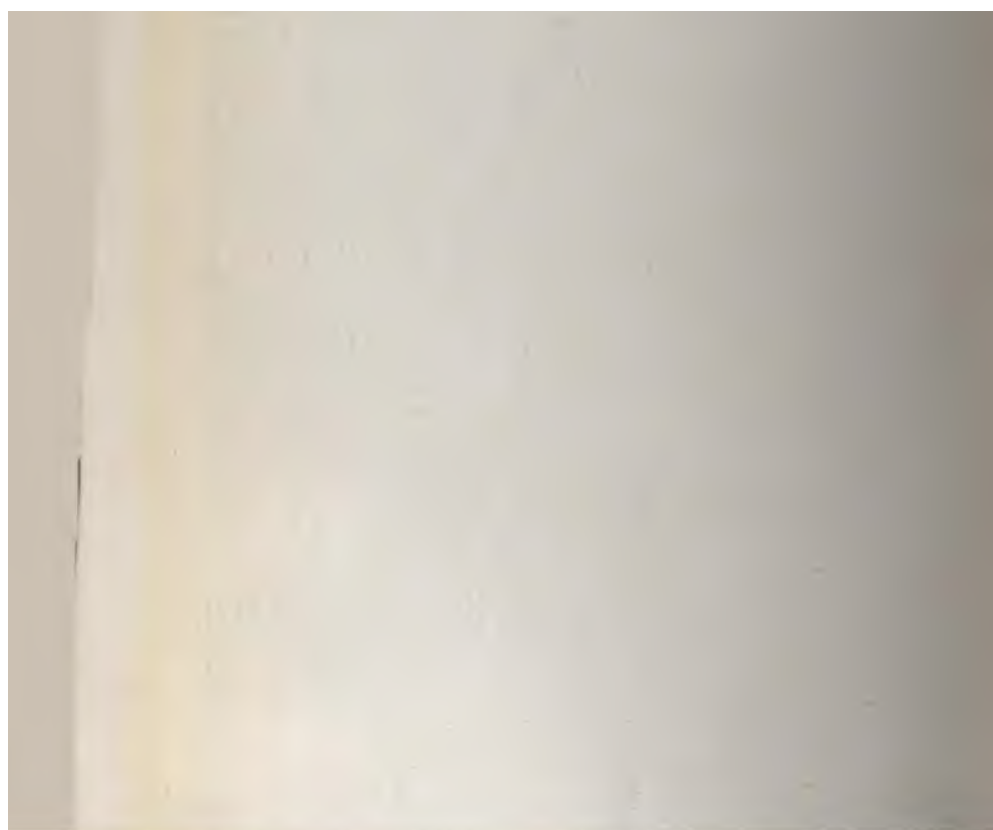
This is the first time that American smoked sausages have been introduced into this market for sale, and their appearance caused some curiosity among the usual dealers in Italian sausage, owing to their cheapness. They sell at not more than three-fourths the price of the Italian article. The Italian sausage is not smoked and is therefore more palatable, although there is greater danger of its deteriorating in this climate.—*Consular Report, March, 1899.*

Germany's wool import.—A noteworthy change in favor of South American wool has taken place in German imports within the last few years. Whereas formerly wool from the English colonies, especially Australian wool, formed the main portion of German wool imports, the Argentine Republic has taken since 1897 first rank among the countries interested in supplying this market.

The German wool imports from Great Britain consists almost exclusively of Australian and Cape wool. According to official statistics, Germany imported in 1898 about 71,000 double hundredweights (15,652,660 pounds) of Australian and Cape wool and about as much in 1897, against 970,000 double hundredweights (213,846,200 pounds) in 1895. The wool imported from the Argentine Republic, including that from Belgium, which is mainly of Argentine origin, amounted to 927,000 double hundredweights (204,366,420 pounds) in 1898, against 770,000 double hundredweights (169,754,200 pounds) in 1897 and 750,000 double hundredweights (165,345,000 pounds) in 1895. The falling off in the imports of British colonial wool is chiefly due to the decrease in the imports from Australia; the latter have, since 1895, gone down by one-third. A further decrease in the imports of wool from that country is to be expected during the next few years; for, according to a report from New South Wales, the prolonged drought has caused the colony a direct loss of about 20,000,000 sheep, and the

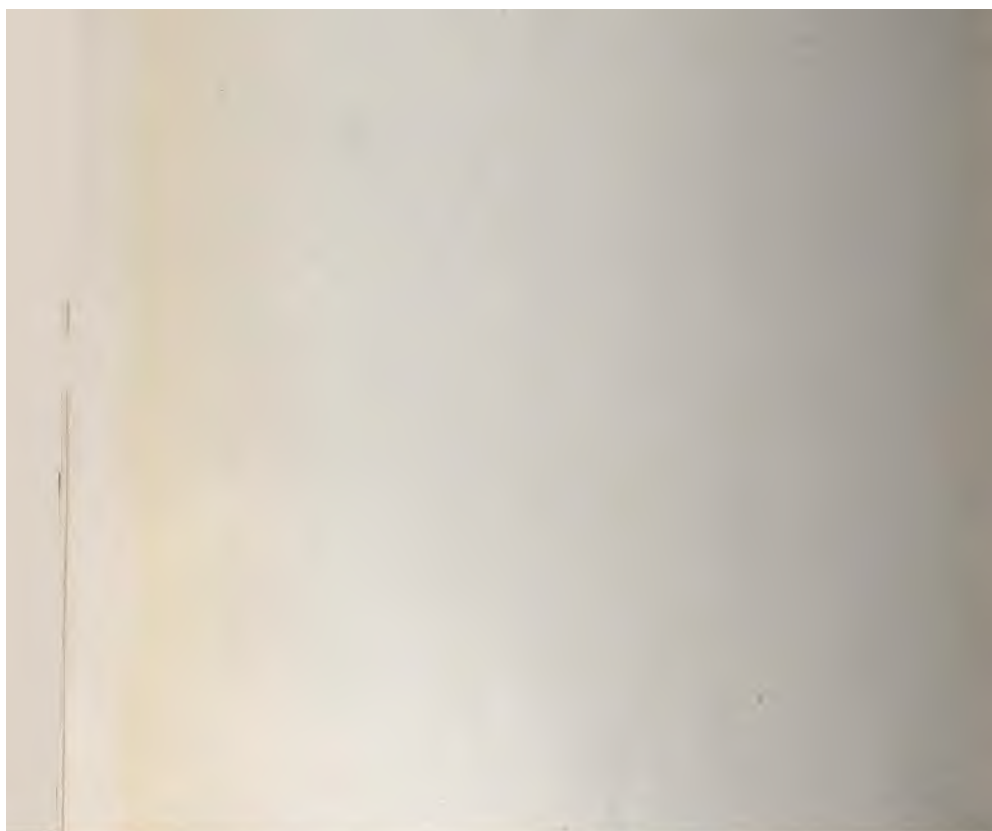


TEXAS STEER GERONIMO.





TEXAS CATTLE.



A. I. 1899.

PLATE XXII.



I consider the present moment most opportune for the introduction into Denmark of American boots and shoes, as the tendency to use readymade shoes is increasing rapidly since the difference in price with those made to order is becoming marked.

The import of foreign-made shoes increases steadily, as will be seen from the following figures:

	Pounds.
1889	194,502
1891	208,663
1893	311,866
1895	364,445
1897	379,452

Austria, Italy, Germany, and, to a small extent, Great Britain, control this market; but there is no reason why our manufacturers should not secure a large share of this trade, as their goods are well finished and elegantly shaped. Pointed and narrow shoes will not sell here; the Danish foot is large.

Our manufacturers have studied the German markets, and I think the same styles will find favor here.

Several of the Danish shoe manufacturers have imported American machinery, but the Danish duty on shoes being very light (it varies according to the quality, and I fear it would be misleading to quote it), our manufacturers can no doubt compete in price.

Denmark has a population of about 2,350,000 inhabitants. The Danish shoe manufacturers produce about 4,000 pairs of shoes daily. The imports of foreign shoes are about 40 per cent of the whole consumption.

Leather manufactures in Germany.—In the whole record of industrial development in Germany during the past four years there has been no feature more striking and significant than the progress of the tanning and leather industries, which now rank about fourth in the productive interests of this country. As early as 1895 no less than 596,717 persons were engaged in tanning and the manufacture of shoes, leather gloves, belting, and saddlery, and the value of leather consumed annually by the German people exceeds \$100,000,000, exclusive of exports, which amounted during the first eight months of 1898 to 8,744 tons, and average in aggregate annual value \$50,000,000.

Special branches of the leather industry are concentrated at different points, as, for instance, the manufacture of shoes at Pirmasens, Weissenfels, and Tuttlingen; purses, bags, and a vast assortment of fine leather goods at Offenbach, Frankfort, and Hamburg; and tanning at Worms, Strassburg, Siegen, Barr, Malmedy, and Paknang, as well as in the vicinity of Hamburg. There are in Alsace-Lorraine alone 82 tanneries, a single one of which—at Strassburg—employs 250 workmen and tans 60,000 hides per annum. The hides tanned in Alsace-Lorraine are of domestic origin, or are imported from North

and South America and from India. The material used is largely the very superior white-oak bark furnished by the forests of the Vosges; but in later years imported forms of tannic acid, quebracho, palmetto, and gambier, as well as chrome, have been introduced there and now play an increasingly important rôle. The whole subject has an especial interest for Americans from the fact that the German shoe and leather industries are in a state of transition from the slow and primitive methods of hand labor to the most modern forms of chemical tanning and shoe production, and because this transformation consists largely in the adoption of American methods and machinery.

The importation of American leather to Germany, which began soon after the last world's exposition at Vienna, has increased steadily until there are now in Frankfort alone 11 firms which import and deal more or less exclusively in shoe, glove, and harness leathers from the United States. As this leather is largely made from hides and skins imported originally from Europe, its high quality and the fact that it can be exported from the United States and sold at a profit in this country, notwithstanding the German tariff, showed the German tanners how far their American competitors had outstripped them in the race for cheap and superior production, and set before them a lesson which they have been quick and eager to learn.

A leading New England manufacturing company which turns out exclusively high-class tanning machinery has been compelled to enlarge its plant to meet the heavy demands from its European agent, who, beginning three years ago with an office in Frankfort, has now extended his trade throughout Germany and into Austria, Italy, and Russia. Leading German tanners have visited the United States, and being everywhere freely admitted, have studied carefully and intelligently American processes and machines; and numerous expert workmen and foremen, skilled in the use of chrome, quebracho, and palmetto, have come to this country and received large compensation for teaching their arts to the native tanners. In addition to all this the tanning industry in Germany enjoys the important natural advantages of an abundant supply of hides and skins of the best qualities, cheap and profuse tanning materials, advanced chemical skill at wages less than those of manual labor in the United States, abundant capital at 3 and 4 per cent, manual labor that costs on an average 15 marks (\$3.57) per week, and a home market adequately protected and open to the import of foreign-made machinery at a nominal duty of 71 cents per 100 kilograms (220 pounds).

The German tanner has not only all these points in his favor but, what is perhaps still more important, his home market is of extraordinary capacity. The consumption of leather in Germany is almost phenomenal. Notwithstanding the enormous increase in the home-tanned product, the imports of leather are now greater than ever before. Several of the largest tanneries in the Empire have either been built

during the past two years or wholly reorganized and equipped with American machinery. In this immediate neighborhood is an establishment which turns out about 800 dozen glazed chrome kid skins per day. Another large tannery has been converted by an expert from New York into a stock company, with a large capital and modern American equipment. Messrs. W. Becker & Co., of Milwaukee, are just finishing a new tannery near Frankfort, where they will in the future manufacture the leather to supply the large trade they have built up in Germany with leather heretofore imported from Wisconsin.

Precisely similar in motive and method is the revolution which is going on in the shoe manufacturing industry of Germany—likewise being Americanized and improved in an extraordinary degree. Three years ago large quantities of cheap and generally inferior shoes were imported into Germany from Italy and Austria, a few of better grade from England and Switzerland, and a small quantity of the fine, high-priced work of Pinet, of Paris, to supply the most exclusive trade in large cities. The product of most German factories was then of but medium quality, lacking in style and costly out of proportion to its merits. The American factory-made shoe then appeared, first as a model discreetly imported by the better class of manufacturers and used for the guidance of their operatives. Later, a few of the more enterprising American manufacturers sent salesmen with samples, who made small sales to retailers, especially in such German cities as have a large permanent American colony. The handsome and highly finished imported shoes attracted immediate attention and were sold rapidly, but as no provision had been made for keeping up the stock except by repeated orders sent to the United States, which required from two to three months to be filled, the trade naturally languished. Retailers as well as their customers were pleased with the American shoes, but as they are for the most part merchants of small capital, ignorant of the formalities of importation, timid about paying in advance for goods which they have not seen, and accustomed to being supplied from hand to mouth by European manufacturers, they soon became discouraged with goods which discontented their customers with homemade shoes and created a demand which they could not readily supply.

The American shoe exporters, on the other hand, spent months in seeking for wholesale shoe jobbing houses which do not exist in Germany, and waiting for some one in this country to organize a company or syndicate and open a wholesale depot at Hamburg or Berlin which would buy and import American shoes and supply the German retail trade. Several such schemes have been proposed and discussed, and the requisite capital has seemed easy enough to obtain; but all have failed for want of satisfactory relations with American exporters, most of whom were in doubt as to the real requirements of the market, were

timid about foreign ventures, and while quite willing to sell shoes for cash or its equivalent, have not felt disposed to risk any serious investment in such an enterprise.

It is nevertheless true that the importation of American shoes into Germany is slowly increasing, and that the value of such imports during the year 1898 will exceed those of any previous year; but, as has been justly remarked, this increase is due mainly to the fact that there is in all the larger German cities a definite demand for American shoes, which the principal dealers find it profitable to gratify by keeping on hand a small stock, which they sell for the most part at extravagant prices, the kinds sold everywhere in the United States for \$3.50 and \$4 being sold here for 26 and 28 marks (\$5.18 to \$6.66) per pair. Nor do the German retailers, as a rule, make any effort to sell American shoes unless they are specially asked for.

All this has served to convince several clever American shoe manufacturers who have been here during the past three months and have studied the situation closely, that the plan which now offers the best chance of immediate and complete success, is for American shoe exporters, either individually or in combination as a syndicate, to do just what they have done in London and Paris, namely, to open in Berlin, Hamburg, Dresden, Frankfort, and other leading German cities handsome, well-located retail stores, fitted up in American style and stocked with about three grades—fine, medium, and ordinary—of boots and shoes for men, women, and youths, the goods to be advertised as American, exhibited in show windows with labels showing their prices in marks, and sold for a profit not to exceed 30 per cent above the net cost of the goods delivered at the store. This would enable a large assortment of good, medium-grade stock to be kept for sale at prices which would compete directly and effectively with the best that can be produced in Europe. At home, American shoes of good quality are not a luxury beyond the reach of people of moderate means, and they should not be made so by the rapacity of retail merchants abroad.

Meanwhile the standard of quality in German-made shoes is advancing and improving day by day. The shoes made at Pirmasens, Frankfort, Stuttgart, and Dresden, while not yet equal in style, finish, or wearing qualities to the work of the best American makers, are far superior to what was produced in Germany a year or two ago; and thus the opportunity offered by this market to imported goods is gradually slipping away. At their present rate of progress the German shoe manufacturers, who are now among the busiest and most prosperous employers of labor in the Empire, will be able within a few years to supply and hold their home market against all foreign competition.

What is of especial interest at this time, as an example and indi-

eration of the policy which is making Germany a great manufacturing nation, is the alert readiness and enterprise with which the shoe and leather manufacturers of this country are learning the lesson set before them at the Columbian Exposition of 1893. The chrome tanning process was originally invented by a German, but it was perfected and made industrially successful at Philadelphia. As soon as it was recognized that American tanners produced by that process soft, pliant, and lustrous leathers which could not be rivaled in this country, the German tanners hastened to master and adopt the new method.

Every word published in consular reports or elsewhere which can throw any light on American methods or results in tanning or shoe manufacture is translated, reprinted, and discussed—often disputed—in the trade journals of this country. Scores of German manufacturers and their foremen have visited Lynn, Newark, Philadelphia, Chicago, and other centers of shoe production to study the factory system which produces such consummate results with such economy of labor, and skilled American foremen have been employed to reorganize factories and introduce American methods here. The Good-year, Stanley, and other American shoe-machinery companies, three of which maintain large and busy agencies in Frankfort and place large quantities of the most modern machinery every year, use American-made shoes as models and maintain what are practically schools of instruction for German manufacturers and their workmen. All this is done openly and with a clearly conceived and avowed purpose. Says the chief organ of the German shoe and leather industry, the same which less than two years ago attacked fiercely a United States consular officer who had suggested that there was a field in Germany for the sale of American-made shoes:

As the Americans learn from us, so must we learn from them whenever—as is the case in different forms of manufacture on a large scale—they are our superiors. We must study their technical and mercantile methods or cause them to be studied by competent and well-schooled experts, in order to equal or finally surpass their efficiency. In the chrome-leather manufacture we have now reached this point, and our success in this specialty should point the way to similar progress in the shoe, bicycle, and iron industries.

—(*Frank H. Mason, consul-general at Frankfort.*)

Leather industry in Japan.—The importation of sole leather into this port from the United States, the principal country exporting that article here, fell off somewhat during 1897; but there was a very notable increase during the first six months of 1898, as compared with the corresponding period of 1897. Half year ended June 30, 1897, \$9,894; 1898, \$64,161.

British India is the only competitor worthy of note in exporting sole leather to Japan. During 1897 she sent here \$64,930 worth, against \$162,055 from our country.

The principal countries exporting "other" leather (as classified in the customs returns) to Japan are:

Siam	\$232,821
United States	87,084
Great Britain	75,425

In order to show the extent of the leather trade in Japan the following table is given, taken from the customs returns for 1897, those for 1898 not yet being published:

Imports in 1897.

Articles.	Quantity.	Value.
	<i>Pounds.</i>	
Sole leather	1,421,800	\$231,282
Other leather	1,430,860	461,280
Leather ware		21,759
Hides:		
Buffalo and cow	2,632,680	173,197
Deer	242,147	20,963
Sanba (elephant)	303,004	16,053
Boots and shoes	13,371 pairs	9,540

Nearly all the boots and shoes imported come from the United States, and, as ascertained from recent customs returns, a very noteworthy increase took place during the first nine months of 1898 as compared with that period in 1897, both in the importation and exportation of boots and shoes, as may be seen by the following table:

Imports and exports of boots and shoes.

Description.	1897.		1898 (9 months only).	
	Quantity.	Value.	Quantity.	Value.
	<i>Pairs.</i>		<i>Pairs.</i>	
Imports	13,371	\$9,540	25,123	\$15,110
Exports	16,540	8,655	23,965	14,280

Should the proportion hold good during the balance of 1898, as it probably will, the relative imports and exports will stand thus:

Description.	1897.		1898.	
	Quantity.	Value.	Quantity.	Value.
	<i>Pairs.</i>		<i>Pairs.</i>	
Imports	13,371	\$9,540	33,497	\$30,147
Exports	16,540	8,655	31,953	19,048

Shoemaking machinery has not yet been introduced into Japan.

Monthly returns for the period between January 1 and October 1 last (nine months) show importations of sole leather during that time to have exceeded in value the total importation during the whole of

the preceding year by more than \$10,000, which makes it probable that the total imports of sole leather into Japan during 1898 will exceed the year 1897 by at least \$100,000, the greatest increase coming from the United States.

During 1897 Japan exported to other eastern countries 277,660 pounds of various leathers, valued at \$94,472. Leather is used here also in manufacturing hand satchels, for furniture coverings, and for machine belting, the latter being made in Osaka and Tokyo from the best stock imported.

Japanese leathers of all kinds are cheaper than those imported, and the quality is correspondingly poorer.

As may be seen by foregoing table, rawhides more than double the quantity of those tanned are sent to the country. These come principally from China and Korea, and are buffalo and cow skins. They are used largely as soles for the straw sandals ("sekida") so universally worn in this country. Raw hides are also made into harness and are used in many other ways as we use tanned leather.

TANNERIES.

There are but two tanneries of any magnitude in operation throughout Japan—one located in Osaka and the other in Tokyo—and they are chiefly occupied in supplying the leather wants of the army and navy.

A large tanning establishment is located near Kobe. It was formerly under European management, but, after several unsuccessful attempts to operate it, it has been closed. There are, however, many small "home tanneries" in this country, and they are operated exclusively by the "Etas," a class of persons whose occupation is looked upon as unclean. The beggars, "Kojiki," constitute the lowest class in Japan, and next above them are the "Etas," who monopolize the occupation of killing animals for food, the tanning and dressing of leather, grave digging, and similar work. The "Etas" are popularly supposed to be in possession of a secret method of tanning.

Tanning being looked upon in Japan as a degraded calling, it is not probable that the industry will materially improve here in the near future; and it is for that reason, together with the additional ones that cattle are scarce in this country, and that there is a growing demand in Japan for leather of all kinds, that the United States has a field in which it may largely increase its exportation of this article year by year.—(*Samuel S. Lyon, consul at Osaka.*)

Leather industry in Russia.—Consul-General Holloway sends the following from St. Petersburg, June 9, 1899:

For the purpose of encouraging the leather industry in Russia the Government has decided to place the quebracho tree, found in Chile and Mexico, on the free list.

The principal material for tanning in Russia is willow bark, which

is collected in the early spring by the peasants before field labor begins; consequently, when the question of duty on tanning material is considered, the interests of the peasants are involved.

The willow bark contains but 4 per cent of tannin, while the quebracho tree yields 20 to 24 per cent, and is necessary for the preparation of leather of a high grade. Previous to 1882 tanning material was admitted free, but during that year a duty of $4\frac{1}{2}$ cents per 36 pounds was levied. This was reduced to $3\frac{1}{2}$ cents per 36 pounds in 1896. Last year a committee appointed to consider the question decided, inasmuch as quebracho wood is not raised in Russia, is a necessity, and is only used as a mixture with willow bark and other tanning material employed in the leather industry, to admit quebracho wood in logs and beams free of duty from and after February 15, 1899.

The loss of duty is estimated at \$22,000 annually, and it is expected that sum will be more than replaced by the increased manufacture of leather. Russia is rich in raw skins, which are being exported to England, Germany, and Finland. These countries receive their tanning material free of duty and export leather to Russia.—(*Consular Report for September, 1899.*)

Exports and imports of animal products of Cape of Good Hope.—The following statistics of exports and imports of animal products of Cape of Good Hope for the calendar years 1898 and 1899 are from the Government Gazette of January 30:

EXPORTS.

	1898.		1899.	
	Quantity.	Value.	Quantity.	Value.
Ostrich feathers.....pounds.....	369,778	\$3,742,457	373,182	\$4,007,172
Mohair.....do.....	10,876,014	3,164,243	12,777,306	3,810,976
Hides.....do.....	10,849,235	971,076	1,684,096	160,200
Horns.....number.....	816,161	56,307	289,564	20,592
Horses.....do.....	21	17,347	93	9,348
Goatskins.....pounds.....	3,927,403	508,666	3,736,233	497,784
Sheepskins.....do.....	14,652,851	1,189,429	12,371,256	1,323,424
Wool:				
Fleece—washed.....do.....	1,611,880	7,744,214	261,219	315,086
Scoured.....do.....	5,733,000	27,809,044	1,368,046	1,428,615
Grease.....do.....	66,388,046	6,968,577	63,165,787	8,884,268

IMPORTS.

Milk, condensed.....	\$847,900	\$780,051
Butter (including oleomargarine).....	796,992	667,859
Cheese.....	343,857	326,936
Meats, preserved.....	938,387	1,185,981

The Cape of Good Hope rejoices in an increase in exports of wool in 1899 over 1898 of \$2,030,129; of ostrich feathers, \$462,571; of

mohair, \$644,037; making for these three items alone an increase of \$3,136,737. There is no discouragement in the decrease in exports of horns and hides, amounting in value to \$840,591, as the large figures in 1898 represented animals that had succumbed to rinderpest and other diseases.

Siberian dairy notes.—In 1897 more than 2,500 tons of Siberian butter were sent abroad through St. Petersburg, Taganrog, and Sebastopol. Seven large offices have been opened for the purchase of butter for export, and the farm of the Danish consul sends butter weekly to Denmark. In 1897 dairy machinery to the value of \$50,000 was sent to Siberia, and 30,500 tons, or \$60,000 worth, of fresh butter was manufactured during the first half of 1898.—(*Thomas Smith, consul at Moscow.*)

Potato bread for horses in Germany.—Consul Oliver J. D. Hughes writes as follows from Coburg, March 22, 1899:

Potato bread is used by the natives of Thuringia to feed their horses, especially when they are worked hard in very cold weather. The animals thrive on it, and their health and strength are excellent. The method of preparation is simple and inexpensive. The potatoes are slowly stewed till soft; they are then mashed thoroughly and an equal quantity of corn meal is added. It is mixed into a thick paste with a small quantity of salt. The paste is then divided into 4-pound loaves and allowed to bake till thoroughly done; in the slow country ovens it generally takes from fifteen to eighteen hours. When cold they are fed to the horses and cattle doing heavy work at the rate of four loaves a day, viz, one in the morning, one at noon, one about 4 o'clock, and one at night. With the last about 10 pounds of poor hay are given. It is claimed for this method that horses can do much more work on the same amount of food and that it is good for their teeth.

State live stock sanitary boards, etc., 1899.—

ALABAMA—Dr. Jerome Cochran, Secretary State Board of Health, Montgomery.

ARIZONA—Mr. H. Harrison, Secretary Live Stock Sanitary Commission, Phoenix; Dr. J. C. Norton, Territorial Veterinarian, Phoenix.

ARKANSAS—Dr. R. R. Dinwiddie, Veterinarian Experiment Station, Fayetteville.

CALIFORNIA—Mr. William Vanderbilt, Secretary State Dairy Bureau, 114 California street, San Francisco; Dr. J. R. Lane, Secretary State Board of Health, Sacramento; Dr. C. H. Blemer, State Veterinarian.

COLORADO—Mr. B. H. Du Bois, President Veterinary Sanitary Board, Denver; Dr. Sol. Bock, Secretary and State Veterinary Surgeon, Denver; seven State inspectors.

CONNECTICUT—Mr. William B. Sprague, Commissioner on Domestic Animals, Andover.

DELAWARE—Dr. E. B. Frazier, Secretary State Board of Health, Wilmington; Dr. Arthur T. Neale, Consulting Veterinarian to State Board of Health, Newark.

FLORIDA—Dr. Jos. Y. Porter, Secretary State Board of Health, Key West.

GEORGIA—Mr. O. B. Stevens, Commissioner of Agriculture, Atlanta.

IDAHO—Mr. Robert P. Chattin, State Sheep Inspector, Mountainhome.

ILLINOIS—Mr. C. P. Johnson, Secretary State Board of Live Stock Commissioners, Springfield; Dr. C. P. Lovejoy, State Veterinarian, Princeton; fifty-eight assistant State veterinarians.

INDIANA—Mr. M. S. Claypool, President State Live Stock Sanitary Commission, Muncie; Mr. Mortimer Levering, Secretary State Live Stock Sanitary Commission, Lafayette; Dr. F. A. Bolser, State Veterinarian, Newcastle.

IOWA—Dr. J. F. Kennedy, Secretary State Board of Health, Des Moines; Dr. J. I. Gibson, State Veterinarian, Denison; twenty-three assistant State veterinarians.

KANSAS—Mr. Taylor Riddle, Secretary Live Stock Sanitary Commission, Marion; Dr. Paul Fischer, Consulting Veterinarian to Live Stock Sanitary Commission, Manhattan.

KENTUCKY—Dr. J. N. McCormack, Secretary State Board of Health, Bowling Green; Dr. F. T. Eisenman, State Veterinarian, Louisville.

LOUISIANA—Dr. W. H. Dalrymple, State Veterinarian, Baton Rouge; Mr. Fernando Estopinal, Live Stock Inspector, Arabi.

MAINE—Dr. George H. Bailey, State Veterinarian, Deering; Mr. John M. Deering, Cattle Commissioner, Saco; Mr. F. O. Beal, Cattle Commissioner, Bangor.

MARYLAND—Dr. A. W. Clement, State Veterinarian, 916 Cathedral street, Baltimore; fourteen assistant State veterinarians; Mr. C. W. Melville, Secretary Live Stock Sanitary Board, Westminster.

MASSACHUSETTS—Dr. John M. Parker, Secretary of Board of Cattle Commission, Boston; Dr. Austin Peters, President State Board of Cattle Commissioners, Commonwealth Building, Boston.

MICHIGAN—Dr. Geo. W. Dunphy, State Veterinarian, Quincy; Hon. Henry H. Hinds, President State Live Stock Sanitary Commission, Stanton.

MINNESOTA—Dr. H. M. Bracken, Secretary State Board of Health, Pioneer Press Building, St. Paul; Dr. H. M. Reynolds, Director Veterinary Department, State Board of Health, St. Anthony Park; six State field veterinarians.

MISSISSIPPI—Dr. John F. Hunter, Secretary State Board of Health, Jackson; Dr. J. C. Robert, Consulting Veterinarian to State Board of Health, Agricultural College.

MISSOURI—Dr. Willis P. King, Secretary State Board of Health, No. 1 Fountain Place, Kansas City; Dr. D. F. Luckey, State Veterinarian, Thayer.

MONTANA—Dr. M. E. Knowles, State Veterinarian, Helena; Mr. C. F. Powers, President State Sheep Commissioners, Helena; Mr. Cornelius Hedges, Secretary State Sheep Commissioners, Helena; five sheep inspectors.

NEBRASKA—Mr. H. R. Corbet, Secretary State Board of Health, Lincoln.

NEVADA—Dr. W. H. Patterson, Secretary State Board of Health, Reno.

NEW HAMPSHIRE—Mr. N. J. Bachelder, State Cattle Commissioner, Concord.

NEW JERSEY—Dr. Henry Mitchell, Secretary State Board of Health, Trenton; Mr. Franklin Dye, Secretary Tuberculosis Commission, Trenton; State Board of Agriculture, D. D. Devise, President, E. B. Voorhees, Vice-President, W. R. Lippincott, Treasurer, Franklin Dye, Secretary.

NEW MEXICO—Mr. Salomon Luna, President Sheep Sanitary Board, Los Lunas; Mr. Harry F. Lee, Secretary Sheep Sanitary Board, Albuquerque; forty sheep inspectors; Mr. J. A. LaRue, Secretary Cattle Sanitary Board, East Las Vegas; twenty-four cattle inspectors.

NEW YORK—Dr. Baxter T. Smelzer, Secretary State Board of Health, Albany; Dr. F. W. Smith, Secretary Tuberculosis Committee of State Board of Health, 700 South West street, Syracuse.

NORTH CAROLINA—Mr. John R. Smith, Commissioner of Agriculture, Raleigh; Dr. Cooper Curtice, Consulting Veterinarian, Raleigh.

NORTH DAKOTA—Mr. J. W. Dunham, Chief State Veterinarian, Fargo; nine district State veterinarians in North Dakota.

OHIO—Dr. D. N. Kinsman, Secretary State Live Stock Commission, Columbus; Dr. H. J. Detmers, Veterinarian State College, Columbus.

OKLAHOMA—Mr. R. J. Edwards, Secretary Live Stock Sanitary Commission, Oklahoma City.

OREGON—Dr. William McLean, State Veterinarian, Portland.

PENNSYLVANIA—Dr. Leonard Pearson, State Veterinarian and Secretary State Live Stock Sanitary Board, Harrisburg; one hundred and fifty consulting veterinarians.

RHODE ISLAND—Dr. John S. Pollard, State Veterinarian, Providence.

SOUTH CAROLINA—Dr. G. E. Nesom, State Veterinarian, Clemson College.

SOUTH DAKOTA—Dr. J. W. Elliot, State Veterinarian, Aberdeen.

TENNESSEE—Mr. W. H. Dunn, Live Stock Commissioner, Nashville; Dr. Julius W. Scheibler, State Veterinarian, Memphis; four State live stock inspectors.

TEXAS—Hon. R. J. Kleberg, Secretary Live Stock and Sanitary Commission, Corpus Christi.

UTAH—Dr. T. B. Beatty, Secretary State Board of Health, Salt Lake City.

VERMONT—Mr. C. J. Bell, Secretary Board of Agriculture and Cattle Commission, East Hardwick.

VIRGINIA—Dr. Charles McCulloch, State Veterinarian, Blacksburg; Dr. E. P. Niles, Veterinarian to Live Stock Board of Control and Station Veterinarian, Blacksburg.

WASHINGTON—Dr. Elmer E. Heg, Secretary State Board of Health, North Yakima; Dr. S. B. Nelson, State Veterinarian and Veterinarian of the Agricultural Experiment Station, Pullman; four assistant State veterinarians.

WEST VIRGINIA—Dr. A. R. Barbee, Secretary State Board of Health, Point Pleasant; Mr. D. M. Sullivan, Secretary State Board of Agriculture, Charleston.

WISCONSIN—Dr. H. P. Clute, State Veterinarian, Marinette.

WYOMING—Dr. George T. Seabury, State Veterinarian, Cheyenne; three assistant State veterinarians; Mr. E. P. Snow, Secretary Board of Sheep Commissioners, Cheyenne.

Distribution of tuberculin, mallein, and blackleg vaccine.—The amount of tuberculin distributed by the Bureau of Animal Industry in 1899 was 33,400 doses. It was sent into the following States and Territories in the number of doses stated:

Minnesota	10,674	Massachusetts	246
Vermont	6,636	Wisconsin	600
Illinois	6,837	Connecticut	192
Michigan	1,254	California	1,481
Iowa	1,590	Oregon	337
New Jersey	1,464	Missouri	342
Colorado	201	War Department	408
South Carolina	306	Inspectors of Bureau	507

In addition to the States named above smaller amounts of tuberculin have been furnished to the following States and Territories:

Utah.	West Virginia.
Maine.	Kansas.
Washington.	Nebraska.
Arizona.	North Carolina.
District of Columbia.	Tennessee.
Indiana.	Maryland.
Oklahoma.	Marine-Hospital Service.
Mississippi.	

Total amount of mallein sent out, 10,722 doses, distributed as follows:

War Department.....	8,820	South Dakota.....	204
Minnesota.....	134	Oklahoma.....	103
Iowa.....	156		

In addition to the States mentioned above, small amounts of mallein have been furnished to the following States and Territories:

Alabama.	Arizona.
Montana.	Mississippi.
Kansas.	North Dakota.
Nebraska.	Vermont.
Washington.	California.
Michigan.	Maryland.

The number of doses of blackleg vaccine distributed during the year is shown in the following statement:

Arizona.....	5,375	North Dakota.....	34,943
Arkansas.....	4,280	Ohio.....	20
Colorado.....	80,637	Oklahoma.....	44,463
Idaho.....	1,945	Pennsylvania.....	1,800
Illinois.....	1,815	Oregon.....	890
Indiana.....	100	South Dakota.....	40,775
Indian Territory.....	48,530	Texas.....	121,310
Iowa.....	5,815	Utah.....	5,885
Kansas.....	125,675	Virginia.....	30,833
Kentucky.....	655	Vermont.....	310
Michigan.....	40	Washington.....	2,810
Minnesota.....	2,400	Cuba.....	1,300
Mississippi.....	40	Jamaica, West Indies.....	600
Missouri.....	8,195	West Virginia.....	1,310
Montana.....	1,320	Wisconsin.....	70
New Mexico.....	6,175	Wyoming.....	21,635
New York.....	290		
North Carolina.....	3,045	Total.....	718,020
Nebraska.....	112,735		

THE SEVENTH INTERNATIONAL VETERINARY CONGRESS.

By VICTOR A. NØRGAARD, V. S. (Copenhagen),
Chief of Pathological Division, Bureau of Animal Industry.

In May, 1899, the Secretary of Agriculture was requested by the executive committee of the Seventh International Veterinary Congress to send a representative to Baden-Baden, Germany, where the sessions were held from August 7 to 12, 1899, and the honor fell to the present writer.

The purpose of these great international gatherings of veterinary surgeons from all parts of the world, which occur only every fifth year, is principally to bring together the specialists in all the various branches of veterinary science, and, through a free exchange of opinions based upon research and practical experience, to reach definite conclusions as to the most uniform and practical methods of dealing with the great economic questions of the suppression and prevention of animal diseases and the regulation of international live stock trade.

SUBJECTS DISCUSSED.

It will easily be understood that the subjects to be discussed at an international congress must of necessity be limited in number and must embrace such questions as are of importance to a majority of the countries represented at the meeting. It is, therefore, not surprising that the principal topics of the present congress, where twenty-six different countries were represented by more than 900 delegates, were tuberculosis, the infectious swine diseases, and foot-and-mouth disease. Tuberculosis has practically been the principal subject in nearly all of the preceding six international congresses, although it was not until Koch's discovery of tuberculin that the extent of its depredation became fully known and that its suppression became of such immense economic importance. Foot-and-mouth disease is probably the scourge from which the European countries suffer the greatest annual loss, while the infectious swine diseases, of which Europe is burdened with three—hog cholera, swine plague, and rouget—come as a close second.

Among other subjects of interest to the live stock industry in the United States may be mentioned the preventive measures against the spread, through international traffic, of infectious diseases. A thorough discussion on this subject took place. The convention came

to the conclusion, however, that the moment had not yet arrived for laying down definite principles for an international agreement, and in this respect left every country to look out for itself.

Meat inspection was also discussed at great length, and very comprehensive resolutions, which will be given in full later on in this article, were passed. Compulsory inspection of all meats by thoroughly educated professional inspectors, who in all cases must be competent veterinarians, is what the congress recommended and submitted for the consideration of the governments of the various countries which were officially represented. Especial consideration was given to the utilization of meat and milk from tuberculous animals; and on this point it must be admitted that a great reaction has taken place since the last congress in Bern in 1895. All meat from tuberculous animals, except in cases of great emaciation, is passed for consumption, in some shape or other, after the affected organs or tissues have been removed. Milk, on the other hand, is only to be used in sterilized condition, and animals kept for dairy purposes must be subjected to regular veterinary inspection, and those that are emaciated or suffering from tuberculosis of the udder are to be immediately destroyed and indemnity paid by the state.

PREVENTIVE MEASURES AGAINST TUBERCULOSIS.

The principal paper on this subject was that of Prof. B. Bang, dean of the Royal Veterinary College in Copenhagen, and chief state veterinarian for Denmark. Professor Bang was among the first to utilize Koch's discovery of tuberculin as a means of diagnosis for tuberculosis in animals. Realizing the immense benefit to be derived from it, he at once set about to test it on a large scale. The very encouraging results obtained led him finally to attempt the eradication of tuberculosis from Denmark, and it is his efforts along this line which are discussed in his paper. As Professor Bang has come to be looked upon as the first authority on this subject, his paper will be given in full:

The spread of tuberculosis among the domesticated animals must be checked and every effort made to eradicate it, for these two reasons: First, on account of the danger of infection to which man is exposed through the consumption of meat or milk from tuberculous animals or through the excretion of tubercle bacilli from the living animal; and second, on account of the immense economic loss entailed by the disease. As the first of these reasons will be discussed in another section of this congress I will limit myself to the question of tuberculosis as a disease of animals.

Among the various classes of domesticated animals none are so susceptible to tuberculosis as cattle, and special attention will therefore be given to bovine tuberculosis.

Tuberculosis is an infectious disease—that is, the disease is transmitted from one individual, be it man or animal, to another through the agency of the tubercle bacillus. Consequently the way to combat the disease is to prevent the infection from gaining entrance to the system. The infection may take place in utero.

This way, however, is of minor importance, although not by far so rare as was formerly supposed. I have myself had occasion to examine more than 100 cases in either unborn or newly born calves. Nevertheless, the percentage of calves born tuberculous is, even in badly infected districts, less than one-third of 1 per cent. This fact is easily explained when we consider that the infection can only be transmitted from the mother to the fetus either when the disease has developed in the maternal placenta or at a moment when the bacilli are circulating in the blood of the mother—that is, when she is suffering from generalized tuberculosis. But in the great majority of cases where the disease is only localized or restricted to certain organs the placental infection does not take place. A direct infection of the ovum would require either the presence of tuberculous lesions in the ovaries or the male organs of reproduction or the circulation of tubercle bacilli in the blood of either parent.

These hypotheses agree well with the observations made by myself and others regarding the relative frequency with which the presence of tuberculosis has been demonstrated in newly born calves and grown cattle.

Tuberculosis is therefore in the great majority of cases not inherited, but acquired after birth; and on this point most investigators agree, although it is not long since great stress was laid on inherited predisposition. I do not mean to say that the power of resistance against an invasion of the tubercle bacilli (as well as against any other pathogenic microbe) does not vary with the individual; and I even consider it probable that the power of resistance may be inherited as well as any other specific property of the tissues. But it should, according to my opinion, be borne in mind, first, that the greater or less predisposition to tuberculosis depends in all probability more upon the individual power or inclination to localize the disease than upon a constitution which is able to prevent the infection from gaining entrance; and, second, that we de facto know very little about any variations in the inherited predisposition of cattle to tuberculosis.

Until the theory of a special predisposition has been proven, we are not justified in allowing it to influence our efforts to eradicate the disease; and it is, according to my opinion, absolutely wrong to allow the fact that a cow or a bull has reacted to tuberculin to influence our judgment in this respect. As long as the parents are clinically sound and only through the reaction show that they are infected, we need not fear either that the calves be born tuberculous or that they inherit a predisposition to the disease. The calves will be born healthy and will remain so if we succeed in preventing them from becoming infected.

Of far greater importance than the inherited predisposition is, no doubt, the weakness or delicate condition resulting from improper care or from disease; and it is therefore of greatest importance that the calf be fortified against infection by means of a well-regulated diet.

In ordinary life, infection may take place in various ways, and most frequently through the alimentary and the respiratory organs. Infection through wounds or through the milk ducts or by means of copulation is exceptional.

Much discussion has taken place as to whether the respiratory or the alimentary organs are more frequently the channel of infection, but post-mortem observations seem to prove that the bronchial glands and the lungs are involved in a greater number of cases than the mesenteric glands. This question, however, is merely theoretical, and it is of more practical importance to differentiate between (a) infection through ingestion of food containing tubercle bacilli, and (b) infection through cohabitation. So far as cattle are concerned the question is almost exclusively as to the presence of tubercle bacilli in the milk or milk products which are fed to calves. When calves react to the tuberculin test, the lesions are most always found in those places where bacilli, introduced through alimentation, become located; that is, in the retropharyngeal and mesenteric glands. This fact

is, however, so well recognized that it is unnecessary to more than mention it. It might, however, be well to call attention to the great danger connected with the ingestion of milk from tuberculous udders, and, further, that the milk from cows suffering from generalized tuberculosis sometimes contains tubercle bacilli even though the udder is not clinically affected. It is also of interest to recall the statement of A. Ebers to the effect that perfectly healthy milk may become infected from the tubercle bacilli which, no doubt, is often present in the manure of tuberculous cows. This probably accounts for the fact that the calves in a stable where none of the cows suffer from either generalized tuberculosis or tuberculous mammitis frequently are found to have become infected through the feeding with raw milk. It also indicates how cooperative dairies sometimes seem to be the center of distribution of tuberculosis.

The danger connected with the feeding of raw milk can easily be avoided by heating the milk to 85° C. This preventive measure has been adopted in Denmark with the most satisfactory result; but as it is not always carried out as conscientiously as it might be, we must at present devote all our attention to the greatest source of danger, that is, the tuberculous udder. This, of course, is also of the greatest importance to man, especially because the milk from the affected gland often retains its normal appearance for upward of a month after the infection has taken place, and, no doubt, is often consumed. In further stages of progress, cases where the milk has become watery and flocculent and no longer is milked into the pail, the habit of milking the affected gland out on the stable floor no doubt adds to the infection of the stable. It must therefore be considered a great step forward that a law has been passed in Denmark whereby all cows with tuberculosis of the udder are destroyed as soon as the diagnosis is officially verified, and indemnity paid by the State.

So far as the older calves and grown cattle are concerned, there is, of course, little chance for infection by means of tuberculous milk. In their cases infection generally takes place through the keeping of healthy animals with tuberculous ones; that is, through the accidental transmission of the tubercle bacilli which are excreted by the affected animals. It is easily understood that the danger of infection is a thousandfold greater in the stable than in the pasture, although the danger in the latter case is not entirely eliminated, especially when the cattle are allowed to roam at large, and when a common watering trough is used. When, on the other hand, the cattle are staked out (as is always the case in Denmark), and when a special watering trough is provided for each cow or for every two cows, then, of course, the danger is reduced to a minimum.

The more dark and ill-ventilated the stable is, and the less clean it is kept, the greater is the danger of infection. The arrangement of the cows in rows and the feeding and watering from a common trough increases the danger, especially when the stanchions and troughs consist of old, porous woodwork, which it is difficult to disinfect. But even with the most modern hygienic construction of the stable, and with the most painstaking cleanliness, it is impossible completely to eliminate the danger. The bacilli excreted by the affected animals will, in the course of months and years, accumulate to such a degree that healthy animals when introduced in the stable soon will become infected. They inhale the bacilli in either a dry or a moist condition, or they take them in with food or water. That this really is the case is fully proven through the tuberculin test, which demonstrates that on large estates, where tuberculosis has been prevalent for years, at least 70 to 80, and frequently 100, per cent of the animals react in spite of their healthy appearance; while, on the other hand, it is frequently observed that in stables where tuberculosis has not been introduced all of the animals fail to react, with the exception, perhaps, of a few newly purchased animals, and maybe their immediate neighbors in the stable.

The fact that in highly infected stables we find that all the grown animals and the greater part of the young stock all react to the tuberculin test, while the calves under two to three months old do not react, goes far to prove the immense danger of cohabitation. When the young calves are separated from the other cattle and kept in a stable by themselves, then they rarely become affected, and if it does occur it is nearly always through the means of tuberculous milk.

From the above we conclude that the chief danger of the spread of tuberculosis among cattle is the prolonged cohabitation in stables, which is necessitated by the climatic conditions of Denmark.

The more or less favorable results which we have obtained in our attempts to eradicate tuberculosis from various herds or stables demonstrate fully the influence of cohabitation in favor of contamination. In many cases the owners of the stables or herds did not feel inclined to make pecuniary sacrifices in order to effect a thorough separation between the healthy and the affected animals, but contended that it would be sufficient to erect a partition in the stable, and to place the healthy animals on one side and the affected on the other, or even merely to prevent their coming in direct contact with each other by means of a partial partition between each stall. In such cases the repetition of the tuberculin test in the course of a year always demonstrated that little or nothing had been gained. On the other hand, a thorough separation and the conscientious carrying out of the rules laid down to prevent the infection being carried from the one lot to the other nearly always gave satisfactory results. Most effective is, of course, the separation when the healthy animals can be placed on one farm, while the affected ones remain on another one; but as this in most cases is impracticable, the next best precaution is to place them in different stables on the same farm. Less effective is the division of the stable by means of an air-proof wall, and least effective is the division by means of a wall provided with a door. But even under these circumstances have I seen rather encouraging results, especially when the door in question was opened only when it was absolutely necessary.

The principal point to be observed in combating tuberculosis among cattle is, therefore, to prevent the infection of the healthy animals by means of complete separation from the affected ones. The first step is, of course, to demonstrate which are the infected animals in a herd. Before the discovery of tuberculin this was practically impossible, while to-day we have an almost unfailing means for the recognition of the affected ones.

When a hitherto untested herd is submitted to the tuberculin test, the temperature record in the greater majority of cases points clearly to the affected animals. Those that react typically are, as a rule, always tuberculous, even though the reaction does not indicate to what extent they are affected. Of those that do not react, at least nine out of ten are free from tuberculosis. It is, however, a well-known fact that some of the worst affected animals do not react to the test, but these are easily recognized on physical examination, especially if rectal exploration is resorted to. If the physical examination is either omitted or performed in a careless manner, highly infected animals may be left among the healthy ones, simply because they did not react, and the success of the entire measure may thus be jeopardized. Mistakes of this kind are, however, rare. More frequently does it occur that animals which did not react exhibit on post-mortem examination the presence of one or more cheesy calcareous nodules, or foci, in one or more lymph glands. This, however, can not be avoided, and even if such animals were placed among the healthy ones, it is hardly possible that any harm would result from it, as such lesions, as a rule, are retrogressive, and very seldom become recrudescant.

When, therefore, a herd is to be freed from tuberculosis through the separation of the healthy from the affected animals we find that tuberculin, in spite of its faults, is of inestimable value, if used with discretion and care.

To the objections already mentioned must be added the fact that the animal system can become adapted, through repeated injections, to the presence of tuberculin. It has been frequently observed that when a reacting cow is retested after a short while it no longer reacts. This temporary insusceptibility is, however, more frequently observed as the result of repeated injections, and it has made it unsafe to place too much reliance on the tuberculin test when purchasing cows for a clean herd. It would therefore seem desirable to make it obligatory to brand all animals that have been tested, but this can not be enforced until all cattle must be tested. Until then we have to content ourselves with an affidavit from the owner, or else refrain from purchasing cows from unknown or unreliable parties.

I have formerly mentioned the circumstance that a few animals which react on the first injection fail to react when retested after a period of a whole year. The reason for this is not as easily explained as the temporary immunity resulting from a number of injections within short intervals. In a number of these cases I have found on post-mortem examination a small amount of old, stagnant, or obsolete tuberculous processes, but in other cases I found extensive lesions. It is therefore of importance that this fact be known, as many cattle owners would feel inclined to consider such a nonreacting animal as cured and remove it to the stable with the healthy animals. But a cow which, as the result of a typical reaction, has once been placed in the stable among the affected ones should never be transferred to the healthy division.

It must furthermore be mentioned that cattle which have been removed from their usual surroundings—have been shipped or driven to market—give a less typical reaction than they would under ordinary circumstances, or they do not react at all. It seems as though the physical impressions or the excitement has a depressing effect upon the thermal centers which record the effect of those substances which result from the influence of tuberculin on the tuberculous tissues. It is therefore advisable that such animals be kept for at least a few days before they are tested, that a larger dose of tuberculin be injected, and that a lower temperature be accepted as a typical reaction. The above-mentioned objections tend naturally to diminish the value of tuberculin: but it is, nevertheless, for all practical purposes, of inestimable benefit to us in our efforts to suppress tuberculosis among cattle.

From the above considerations of the various ways in which infection takes place it is easy to arrive at the precautions which each individual cattle owner must take in case he desires to develop a new and healthy herd out of the old infected one. Calves whose mothers are highly tuberculous ought not to be raised, but all the other ones should be removed from the infected stable as soon as they are born and should be protected against infection through alimentation. This is done simply by boiling or else heating to 85° C. all the milk which is given to them. The calves can tolerate the boiled milk from the second day, but must be given the colostrum milk on the first day. The danger from this is exceedingly small.

When these precautions are taken, and when the possibility of infection being transmitted by means of stable utensils or attendants is excluded, the calves will without doubt remain healthy. In this way a new and healthy herd might be developed, even without the use of tuberculin, but the process is slow and expensive; and when the diagnostic importance of tuberculin became known I proposed that the entire herd at once be tested and that the reacting animals be separated from the healthy ones as completely as possible. Furthermore, I proposed that the latter be retested every year, or, still better, every six months, in order that those which in spite of our efforts have developed tuberculosis may be removed with as little delay as possible. When these rules are followed to the letter I have no doubt that the result will be satisfactory, and even when the separation between the

two herds be not as ideal as could be desired have I seen great improvement result. The method was first tried on a large estate in Denmark (Thurebylille) in 1892, and has since then been employed on a great number of farms and estates both in Denmark and in other countries. The results, which were published at the International Veterinary Congress in Bern in 1895, and at the Tuberculosis Congress in Paris in 1898, prove beyond doubt that the method is both rational and practical, although the complete separation of the two herds is attended with considerable difficulties and requires eternal vigilance. Neither can it be denied that the above-mentioned irregularities and variations in the effect of the tuberculin sometimes causes a great deal of trouble and annoyance.

When I am now asked whether my rather long experience with the question would not prompt me to call attention to certain points which perhaps might be easily overlooked but which are essential for a good result, I say, Keep your eye on the animals which have reacted. In case one of these animals develops one of the more dangerous forms of tuberculosis, that is, one in which a profuse discharge of bacilli takes place—as, for instance, tuberculosis of the udder, the uterus, the intestines, or the ulcerative form of tuberculosis of the lungs—the animal in question must be destroyed without delay. Otherwise an enormous amount of bacilli might be excreted daily, which naturally would enhance the danger of the disease gaining entrance to the healthy division.

When we are to deal with a large herd of cattle in which tuberculosis has prevailed for a number of years, the testing of the grown cattle may, as a rule, be omitted. By far the greater majority of them will react even though they look apparently healthy. Experience has taught me that quite a large percentage of those which do not react is not entirely free from tuberculosis. Cattle which for years have been exposed to the infection are seldom entirely free from the disease, but have, as a rule, one or more small tuberculous foci in either the bronchial or mediastinal glands. To this category belong most of the animals which, as mentioned above, fail to react although they are in reality affected. But, although such animals, as a rule, are not dangerous, still there is a possibility of a further development of the disease, and for this reason it is not advisable to place them among the healthy animals. I have therefore made it a rule when dealing with large and thoroughly infected herds to test only the calves and the young stock, and to form the nucleus of a healthy herd out of these when they fail to react. In this manner the owner is spared the sorrow and annoyance of knowing that the greater part of his cattle are affected. In less infected herds I always recommend testing all the animals. This method of eradicating tuberculosis has, in spite of the many drawbacks by which it is attended, been proven to be practical and comparatively inexpensive. It must, however, be remembered that the effectiveness of the method depends to a great extent upon the fact that it is employed by the cattle owner as a voluntary effort to get rid of tuberculosis, and that its usefulness must necessarily suffer if enforced as are other compulsory sanitary measures for the suppression of contagious and infectious diseases in general. The sanitary authorities of the Government should, on the other hand, support this voluntary effort by supplying tuberculin free of cost or at a nominal price, and by paying the fees of the veterinarians who are employed in testing the cattle. This is done in Denmark, Norway and Sweden, and in several other countries.

The question has been raised whether bovine tuberculosis ought not to be classified with those infectious diseases against which the Government or State sanitary authorities should proceed with vigor. The first point to be considered in this connection is whether the source of infection may be eradicated. It has been claimed that the disease is frequently transmitted to the cattle from man, and Professor Guillebeau stated at the Veterinary Congress in Bern that cattle, as a rule, are infected by means of human tuberculous sputum. If this were the case, the eradication of bovine tuberculosis would practically be impossible, but accord-

ing to my opinion and experience the statement is wholly erroneous. The infection of cattle by means of tubercle bacilli excreted by man is, no doubt, possible, and for this reason tuberculous persons should never be employed as attendants. Authentic cases which tend to prove this theory of infection are exceedingly rare. On the other hand, when tuberculosis appears in a hitherto uninfected herd it is easily proven that the infection was introduced by means of an infected animal or else it was caused by feeding the calves with unsterilized milk from a cooperative dairy. The existence of a great number of uninfected herds in countries where tuberculosis is exceedingly prevalent among the inhabitants also indicates that the transmission from man to cattle is of small importance. It has also been proven that in countries where bovine tuberculosis was almost unknown at the beginning of this century, the disease was introduced with the importation of cattle from other countries where the disease was very prevalent. This, for instance, was the case in Denmark.

As the principal source of infection for human tuberculosis is through the transmission of the disease from man to man, so it is in bovine tuberculosis from animal to animal.

The recent experimental researches of Theobald Smith in Boston have proven that cattle may be more easily and more severely infected with culture of tubercle bacilli obtained from a case of bovine tuberculosis than with a culture made from human tuberculosis. The possibility of infection through tuberculous persons should therefore not discourage us in our efforts to eradicate the disease among cattle. The disease in itself is not, as formerly supposed, a ubiquitous disease following the forced development of the milch cow, as we know that there are great numbers of herds of the most excellent dairy cattle which are entirely free from tuberculosis.

The circumstances, however, which make it so exceedingly difficult to eradicate bovine tuberculosis are: (1) The great prevalence of the disease; (2) on account of the mild form in which it frequently manifests itself and which does not justify the destruction of all of the infected animals, and (3) because tuberculin is relatively unreliable for diagnostic purposes.

That tuberculosis is prevalent among the cattle of most of the civilized countries—with the exception of Norway and Finland and certain districts in other countries, for instance in France, where the native unimproved breeds are still comparatively free from the disease—is shown by a careful examination of the slaughterhouse statistics and of the available records of tuberculin tests, which prove conclusively that a very large percentage of the grown cattle is affected with tuberculosis.

Regarding the second point, it is a well-known fact that the tuberculous lesions observed in the abattoirs are, as a rule, so insignificant that they could not possibly have been of any economic importance. I have had frequent opportunities to observe such animals which had reacted to the tuberculin test for a number of years, and in several cases I have found the tuberculous lesions to be exceedingly small and decidedly circumscribed even in cattle which had reacted five or six years previously. The German meat-inspecting statistics prove fully that by far the greater majority of cases of tuberculosis which are met with in the slaughterhouses are so unimportant that the carcasses are passed for human consumption. Siedamgrotzky has shown that in Germany only 2 to 3 per cent of tuberculous carcasses are condemned. Five to 6 per cent is sold under declaration, while the remaining 92 per cent is sold without any restriction. In consequence of this it would seem that the slaughtering of all affected animals would result in only a comparatively small loss, which probably could not be considered sufficient reason for the abandonment of this means of eradication. But the very reason that the most frequent form of tuberculosis is relatively harmless will in most cases induce the official sanitary authorities to refrain from recommending the whole-

sale destruction of all tuberculous animals. In regard to this, much may be learned from the experiments with eradication of tuberculosis which of recent years were undertaken on a grand scale in Massachusetts and Belgium.

In 1894 the Massachusetts authorities decided to destroy all tuberculous animals with as little delay as possible. In each county inspectors were stationed, who had to examine all herds at least twice a year. Every suspicious animal was tested with tuberculin, and in case it reacted it was destroyed and indemnity paid (half of the appraised value). It was soon discovered that the disease could never be eradicated through this method, and it was therefore decided systematically to test all the cattle in three counties. This, however, was found to be too expensive, and the idea was abandoned. In the meantime all cattle imported into the State were tested with tuberculin on the border and only those that did not react were allowed to enter.

During the succeeding years the veterinary sanitary board obtained greater authority, and attempts were made to induce the cattle owners to control the disease in a more rational manner by means of isolation and disinfection, but the result was apparently the same. At the veterinary congress in Nashville, in 1897, Dr. Parker made the statement that the cases of generalized tuberculosis met with in destroying the affected animals was reduced from 32.6 per cent to 3.6 per cent; but the efforts to eradicate the disease must, nevertheless, be considered a failure, as the report of the veterinary committee issued in 1898 admits that in spite of the annual expenditure of \$250,000 no perceptible decrease in the prevalence of tuberculosis could be observed. Consequently, the legislature declined to vote any more funds. This complete failure of the whole undertaking was no doubt due to the large indemnity paid for the condemned animals, the carcasses of which, even when slightly affected, were excluded from consumption.

The Massachusetts experiments demonstrated fully how difficult it is to combat bovine tuberculosis by means of sanitary police regulations, and the same is fully corroborated by the experiments made in Belgium.

The sanitary regulations for the eradication of bovine tuberculosis which took effect in Belgium on the 1st of January, 1896, contained the following paragraphs:

1. It is the duty of every veterinarian and cattle owner to report every case of tuberculosis observed by them in either living or slaughtered cattle.

2. Examination by a veterinarian of the herd to which the affected animal belonged.

3. Destruction of all the clinically affected animals in the herd and of the suspicious ones which have reacted to the tuberculin test. The owner to receive indemnity.

4. Disinfection of the premises.

5. Prohibition against the disposal of suspicious animals (that is, such as have been kept with tuberculous ones) for any purpose but immediate slaughter, with the exception of those that have not reacted.

6. All herds to be tested free of charge to those owners who pledge themselves to establish and maintain a satisfactory separation of the affected and healthy animals. When the presence of tuberculosis has not been demonstrated in a herd, the owner can have it tested at his own expense. Only nonreacting animals are to be placed in the healthy division, and these must be reexamined once a year.

7. Milk from reacting animals must not be disposed of for human consumption until it has been boiled, and the reacting animals must be butchered within one year after they have been tested. At the same time all private persons were forbidden to use tuberculin, and all cattle which were to be imported had to be submitted to the tuberculin test at the border and allowed to enter only when the test proved negative.

Most of these regulations were quite rational; only article 7 was too exacting, as it called for the destruction of all reacting animals, even though they were clin-

ically sound. The result was that in the course of eighteen months it became necessary to change the regulations considerably. In the annual report the secretary of agriculture, under date of August 10, 1897, makes the following statement:

"The numerous tests which have been made in 1896 show that tuberculosis exists in Belgium to such an extent that, in order to eradicate it completely in a relatively short time, it must of necessity cause great hardships in a large number of agricultural communities. Furthermore, the destruction of all cattle which have reacted to the tuberculin test has proven that in the majority of cases the tuberculous animals were so slightly affected that they were absolutely incapable of propagating the disease. Under these conditions the destruction of these animals after a certain fixed period does not seem practicable. As a rule, it is sufficient to isolate them, thereby allowing the owner to use them as long as they do not manifest clinical symptoms of the disease. I have, therefore, decided to modify the regulations of October 30, 1895, in a way to make them less rigorous."

Some of these modifications were very practicable, especially the one which allowed the owner to retain the reacting animals so long as they showed no clinical symptoms, but, on the other hand, the owner was deprived of his right of indemnity in case he retained them more than three years after they were tested. It must also be considered an improvement that the milk from such animals was allowed to be sold without having to be cooked. It was further decided that calves from reacting cows should be immediately removed from the mother and fed on sterilized milk from the second day after birth. Less practicable was the regulation which placed the entire responsibility of reporting new cases on the visiting veterinarian. It was further allowed to dispose of animals which had been exposed to infection for other purposes than for immediate slaughter. This step must be considered decidedly unwise, as a complete eradication of the disease was thereby made impossible. The effort to destroy the unmistakably affected animals was, however, continued with the same energy. The clinically affected animals had to be butchered within a week, and the "clinically suspicious" ones had to be isolated if the owner did not prefer to have them tested, and, in case they reacted, to have them destroyed. The indemnity paid by the Government was increased in that cows which were kept for breeding purposes and pregnant heifers were appraised according to their value as such. This, however, applies only to a herd when it is first examined. Animals which are destroyed later or because they have reacted to the tuberculin test are only appraised according to their beef value.

The regulation which prohibited the disposal of actually affected animals, or those which had reacted to the tuberculin test, was continued in force, but the separation of the healthy ones was modified in that it was permitted to introduce new animals among the healthy ones without having them tested on the condition that they were clinically sound.

This effort to eradicate bovine tuberculosis in Belgium by means of sanitary police regulations is highly interesting. The whole plan was more rational than the one adopted in Massachusetts, where, furthermore, a well-organized veterinary service was lacking, and where a great number of inspectors had no veterinary education. It was also to the advantage of Belgium that general meat inspection had been in operation for several years. Belgium is also a very rich country, the population of which is ever ready to make great sacrifices for the promotion of its agricultural interests. During the year of 1897 more than 1,000,000 francs (about \$200,000) was disbursed as indemnity for the destruction of tuberculous cattle, but nevertheless it was decided to abandon the original plan of a complete eradication of bovine tuberculosis.

At the tuberculosis congress in Paris in 1898 the Belgian chief inspector, Mr. Stubbe, made the following statements:

"It is, according to my opinion, absolutely necessary to proceed slowly but surely. It is not wise to force the events in attempting to reach a goal which can only be attained in the course of time. The eradication of tuberculosis requires both time and money."

The very practical regulation which indirectly compelled the cattle owners to have the animals which in the course of time became affected tested with tuberculin was unfortunately abrogated. "But," says Mr. Stubbe, "the intelligent cattle owners have still recourse to it." Unfortunately the intelligent cattle owners are, as a rule, in the minority.

Up to the present day the Belgian authorities have also failed to enforce regulations for the prevention of the dissemination of tuberculosis through the cooperative dairies. This is, however, an error which may easily be remedied.

I have no doubt that Belgium will ultimately succeed in diminishing the ravages of bovine tuberculosis to a considerable extent, provided that sufficient means are forthcoming to allow the destruction of all clinically affected and "clinically suspicious" as well as all reacting animals. It will, on the other hand, be impossible completely to eradicate the disease so long as the reacting animals are not separated from the healthy ones; and even this measure will not always succeed so long as we can not rely entirely upon the tuberculin test. The most rational method would naturally be to deal with tuberculosis as we do with contagious pleuro-pneumonia, namely, to destroy all the affected animals. But such measures are at present out of the question, except perhaps in a country where tuberculosis has but recently been introduced. Even in such places the possible danger of infection from tuberculous persons ought not to be completely overlooked.

In my opinion the time has not yet arrived when we may begin to think of complete eradication of bovine tuberculosis. For many years to come we will have to content ourselves in efforts to gradually diminish its prevalence, and, whenever possible, to attenuate its virulence and reduce the danger of infection to human beings.

What then, are the measures for attaining this end?

First. Of greatest importance is the dissemination of knowledge regarding the true nature and the manner of infection of tuberculosis, and regarding the importance of the tuberculin test. Information of this nature should be furnished not alone to cattle owners, but to all the inhabitants of the country. Many years of unceasing labor will be required before knowledge of this kind has been disseminated among the masses. In this connection it ought not to be forgotten that the professional theories regarding bovine tuberculosis have undergone immense modifications during the past decade, and especially since the discovery of the diagnostic value of tuberculin, and it is easily understood that it is difficult for laymen to adapt themselves to the modern theories. But without a correct understanding of these points it is futile to look for satisfactory results in our efforts to control the disease.

Second. The second and by far the most important point is left entirely to the cattle owner. It rests with him gradually to free his herd from tuberculosis by preventing the sound animals and the new-born calves from becoming contaminated. The owner who earnestly attempts to do this will always accomplish a great deal, and nothing whatever can be accomplished without his voluntary cooperation. The Government may, however, encourage the efforts of the owner by furnishing him tuberculin and veterinary service free of charge.

Third. The third point consists in the immediate destruction of all thoroughly affected animals. In all cases of ulcerative, pulmonary, intestinal, uterine, and mammary tuberculosis where great numbers of bacilli are daily discharged by the affected animal, it is easily understood that the owners' interests are best served by their immediate destruction. When only the serous membranes or some of

the lymphatic glands are affected the danger is comparatively small. This destruction of highly affected animals must, however, be compulsory, as the owner, in many cases, would refrain from doing it voluntarily, especially when he is ignorant regarding the danger to which the remaining part of his herd is exposed. It is therefore absolutely necessary that the owner should be compelled to report all suspicious cases, that is, chronic pulmonary lesions connected with great emaciation. As soon as the veterinarian satisfies himself as to the tuberculous nature of the lesions, the animals in question must be immediately isolated and destroyed as soon as possible. In cases of chronic lesions in the udder and the uterus, it is always advisable that the presence of the tubercle bacillus should be demonstrated before the animal is condemned. In cases of pulmonary tuberculosis the tuberculin test may be resorted to, but it should be kept in mind that an animal suffering from an emaciating pulmonary disease—as, for instance, lung worm disease—may give a decided reaction as the result of an insignificant tuberculous deposit in a lymphatic gland.

In those countries where compulsory meat inspection has been introduced, it would be well to have the inspectors report all cases of tuberculosis observed on the killing floors. In this way it would be possible to trace the origin of the affected animals, and subsequently cause an examination of the herd from which they came. Such a measure would also be of great value in compelling the cattle owners to report suspicious cases. It would also be well to have all affected herds reexamined by veterinarians not less than four times a year.

It is agreed upon by all authorities that the badly affected animals should be destroyed, but the opinions regarding the indemnity to be paid differ considerably. The majority are in favor of indemnity, and especially in all cases where mistakes have been made in the diagnosis. The question is, however, whether the owner can be considered entitled to receive indemnity for highly affected animals. In countries where the agricultural classes are more or less impoverished indemnity ought no doubt to be paid, although it is a question whether the immediate destruction of animals suffering from dangerous forms of tuberculosis ought not to be considered more in the light of a gain than of a loss to the owner. In no case should the indemnity be very high, as otherwise the owners will be less enthusiastic in eradicating the disease. It should be kept in mind that enormous sums will be required even when the compensations are made as low as possible. The best way of arranging this question would probably be through the introduction of compulsory insurance of all cattle.

The destruction of all the worst cases is absolutely necessary for the control of the disease, but it does not suffice for its eradication. It is therefore necessary that the owners should be encouraged to make individual efforts for the eradication of the disease by means of tuberculin tests and separation. If it prove to be impossible to pay indemnity for all losses, it ought to be understood that only the cattle owners who make earnest efforts to eradicate the disease from their herds will receive indemnity for their clinically affected animals. This would in most cases insure a complete separation of the healthy from the affected animals, and might lead to the branding, for purposes of identification, of all animals which have reacted.

Fourth. Among the most dangerous forms of this disease especial attention should be given to tuberculosis of the udder. This form of the disease serves not alone to spread the infection in an affected herd, but may under favorable circumstances cause its introduction into hitherto unaffected stables by means of the milk products which are returned from cooperative dairies in unsterilized condition. It is, furthermore, this special form of the disease which causes the greatest danger of infection to human beings. For this very reason it is paramount that

special sanitary police regulations should be enforced regarding this form of the disease, even when the authorities fail to agree on adequate measures to be taken against the other dangerous forms of tuberculosis. It is but little short of criminal neglect if steps are not taken to prevent so extremely important a food as milk is from being transformed into a fatal poison. The danger is undoubtedly very great, especially when it is considered that milk from a tuberculous udder retains its normal appearance for weeks after the milk glands have become affected, and it is consequently used for human consumption during this period; unfortunately it has not yet been generally understood that milk should never be consumed except it first be boiled or pasteurized.

Tuberculosis of the udder occurs, as a rule, in animals which are otherwise clinically affected with the disease, but this is not always the case, and this condition may sometimes occur in apparently healthy and fat animals which otherwise are entirely free from tuberculosis. It is therefore advisable that all animals affected with this form of the disease should be immediately destroyed.

Fifth. On account of the great danger of transmitting the disease by means of milk products from cooperative dairies it should be made compulsory that all such products should be heated to 85° C. before their return. The regulation compelling the immediate destruction of all animals affected with tuberculosis of the udder does not make the above-mentioned precaution superfluous, as the milk sometimes may be contaminated in the stable with bacilli excreted in the manure. When it is understood that even the buttermilk must be sterilized (as is the case in Denmark), the cooperative dairies are compelled to heat the cream before it is made into butter. This process has no ill effect on the butter, and excludes, on the other hand, all danger of infection by means of the butter. On account of the especial danger which attaches to separator refuse its immediate destruction should be enforced. According to the Danish laws it must be burned.

The above enumerated regulations are hereby submitted for the consideration of this congress, and for transmission to the various Governments which are here represented. It is not expected that their enforcement will result in the complete eradication of bovine tuberculosis, but that they will cause a perceptible decrease in the ravages of this disease.

In the course of some ten or twenty years it may be possible to take more stringent measures.

Dr. Bang was followed by Dr. O. Malm, chief state veterinarian for Norway. In that country the struggle against bovine tuberculosis was begun in 1894, when a law was enacted classifying tuberculosis among the infectious diseases, and making it compulsory for the owner to report to the sanitary authorities all cases which developed among his cattle. It was also forbidden to dispose of affected animals except for immediate slaughter, and it is now proposed to destroy all affected animals which are sold for other purposes in violation of this rule without paying any indemnity to the owner. At present this rule is enforced only with cattle from foreign countries which are found to be tuberculous when tested at the port of entrance.

In 1895 the state provided money for the examination of cattle by means of tuberculin, and from the beginning of 1895 to the end of 1897 a total of 55,542 head of cattle, in 4,331 herds, were submitted to the tuberculin test. The result was that 1,150 herds, or 26.55 per cent, were found to be infected, and a total of 4,644 animals, or 8.36 per cent, reacted to the test. An examination of the statistics shows

that while the native Norwegian breeds were affected to the extent of 6.2 per cent, the imported breeds, principally Ayrshires, showed 18 per cent affected, and the mixed breeds 10.4 per cent.

The regulations governing the free examination for tuberculosis, and which have been in force since 1895, are the following:

1. Every cattle owner can have his herd tested with tuberculin on application, provided that he agrees to comply with the following rules:
2. The test must be applied to the entire herd without any exception.
3. The tuberculin will be furnished free of charge.
4. All expenses, including the services and traveling expenses of the examining veterinarian, will be paid by the Government.
5. All reacting or suspicious animals must be immediately separated from the healthy ones, either in a stable by themselves or by means of a partition in the stable. Individual feeding troughs must be provided for all the animals, and even on pasture the affected ones must be kept separate from the healthy ones. The stable in which the affected animals have been kept must be immediately disinfected.
7. Animals affected with generalized or with mammary tuberculosis, or with cavernous lesions of the lungs, and all those which are highly emaciated, should be destroyed as soon as possible, and their milk must under no circumstances be disposed of or utilized except when boiled.
8. The sale of tuberculous or suspected animals is forbidden except for immediate slaughter. The same applies to the meat of such animals except when examined and passed by a competent inspector.
9. Calves intended for raising must be isolated and tested before they are introduced among the healthy animals, and are only to be fed with milk from nonreacting cows.
10. No new cow must be introduced among the healthy ones until it has passed the tuberculin test.

Under date of January 27, 1897, an order was promulgated prohibiting the importation of cattle from all countries except Sweden, and from this country only after being quarantined and tested with tuberculin. Those found affected or suspicious are branded and are either destroyed within ten days or returned to Sweden. The importation is allowed only through the two ports, Christiania and Frederikshald. A later order prescribes that all Norwegian cattle which have reacted to the tuberculin test or have been pronounced tuberculous must be plainly marked with a branding iron.

Finally, a sum of money has been appropriated to indemnify cattle owners who submit their herds to the official test. One-half the loss resulting from the destruction of affected animals is paid by the Government.

The method of combating bovine tuberculosis in Norway is therefore based upon the same principle as in Denmark, that is, through voluntary efforts on the part of the cattle owner and with the support of the Government. Nobody is compelled to have his herd examined, but if he desires to have it done and receives the support of the Government he is obliged to comply with the prescribed rules. There is no law demanding the destruction of tuberculous animals, but the

owner is expected to have the far-advanced cases, or those which are especially dangerous as disseminators of the disease, destroyed with as little delay as possible. The remaining reacting animals may be retained so long as they are kept isolated from the healthy ones.

So far as the tuberculin test is concerned, a temperature of 39.5°C . at the critical period is considered a reaction when the temperature previous to the injection was normal. In the case of young animals, however, the temperature must rise to 40°C . to constitute a typical reaction.

Norway is the first country which undertook the testing of tuberculous herds at the expense of the Government, preceding even Denmark in this respect; and the effort of eradication is based upon the voluntary cooperation of the owners with the state sanitary authorities, and upon the discreet employment of coercive measures in conjunction with the payment of a moderate indemnity—a system harmonizing individual liberty with legal compulsion. It seems, however, at least at present, to be the only practical method for the gradual eradication of bovine tuberculosis.

Professor Malm was followed by Dr. Regner, of Sweden, and Dr. Rudovsky, of Austria, both of whom devoted the principal part of their papers to the prevalence and distribution of bovine tuberculosis in their respective countries. Regner especially desired to prove that the disease was less prevalent in Sweden than in Denmark, although the question seemed to be of purely local interest. Rudovsky furnished some interesting statistics illustrating the respective power of resistance or individual susceptibility of the animals of the most common breeds or strains which are kept for dairy purposes in Moravia. While the native breeds are affected only to the extent of from 8 to 24 per cent, the imported grades and breeds, especially Shorthorn and Dutch cattle, show 62 to 66 per cent affected. He also shows that the spread of infection among cattle kept in stables stands in direct proportion to the ages of the animals and to the number kept in each stable. The older the cattle and the larger the herd, the greater the proportion of affected animals.

Dr. Siedamgrotzky, chief state veterinarian for the Kingdom of Saxony and professor at the veterinary college in Dresden, stated that during the past fifteen years it had become more and more evident that energetic action must be taken to check the spread of bovine tuberculosis and eventually to eradicate it. The necessity therefore he bases on the following reasons: (1) On account of the great and direct loss in value in beef cattle and swine which on post-mortem examination are found tuberculous; (2) on account of the indirect loss in value of affected animals that are unable to yield returns in proportion to their cost and keep; (3) on account of the alarming spread of the disease, and (4) on account of the danger of infection to human beings.

Dr. Siedamgrotzky estimates the direct loss from tuberculous animals condemned in the abattoirs of Germany or sold under declaration to be about \$1,500,000 annually, and similar losses from tuberculous hogs to be about \$442,000. In Saxony about 27 per cent of all cattle butchered for consumption is found to be affected with tuberculosis, but only about 2 per cent of these is condemned in toto, while of the remaining 25 per cent only 6 per cent is sold under declaration and 19 per cent is sold as healthy beef after the affected parts have been removed. These figures indicate most clearly the great prevalence of bovine tuberculosis in Saxony. But, says Professor Siedamgrotzky, the figures obtained from certain smaller cities which obtain their beef supply from their immediate neighborhood are little short of amazing. The following cities are especially mentioned: Löbau, 45 per cent (1894); Meissen, 49 per cent (1895); Frankenberg, 35 per cent (1896); Schleswig, 39 per cent (1896); Twickau, 45 per cent (1897); and Kiel, 47 per cent (1897). These post-mortem observations are fully borne out, so far as Saxony is concerned, by the results obtained by means of the tuberculin test. Fifty, 60, 70, and even 80 per cent of affected animals in a herd seem to be the rule rather than the exception.

Professor Siedamgrotzky next proceeds to consider the danger of infection to man and recalls the principal inoculation and feeding experiments with meat and meat juice from tuberculous persons and animals, and in summarizing these he comes to the conclusion that there is very little danger of infection to either man or beast from the consumption of the meat of even very badly affected tuberculous animals. These conclusions, however, must not lead us to consider the carcasses of tuberculous animals as perfectly harmless, but they should simply help to prove the absolute necessity for an efficient and general meat inspection, by means of which the meat of tuberculous animals may be extensively utilized.

Regarding the milk of tuberculous cows, there can be no doubt of the danger from its consumption, especially when the udder is affected. Fortunately this form of the disease is comparatively rare. During a period of nine years (1888-1897), only 1,040 cases of tuberculous mammitis were found among 259,109 cows and heifers which were killed at the abattoirs in Saxony. This makes 0.4 per cent of the whole number, and 1.48 per cent of those found otherwise affected with tuberculosis (70,156).

Regarding the manner of infection, he says the danger is very small in free air and exceedingly great where the animals are kept indoors for any length of time. This he means to prove by the fact that horses, swine, and sheep, which, in his opinion, are equally as susceptible to tuberculosis as cattle, are much less frequently affected, and because many herds of cattle in which the disease was never introduced have remained permanently free from the infection.

That calves may inherit the disease has been proven beyond doubt

through a number of observations made on post-mortem examination of fetuses, or newly born calves. This manner of infection is of small importance, however, as it takes place so rarely as to be left out of consideration.

Of more importance, by far, is the infection of young calves by means of the milk from tuberculous mothers. That the infection of the calves most frequently takes place through the alimentary canal is proven by the fact that on post-mortem examination the primary lesions in such young animals are most often found to be located in the retropharyngeal and mesenteric glands. But even this manner of infection is of small importance as compared with the one great source of transmission, namely, cohabitation. As this subject has been discussed in full by Dr. Bang, and as Professor Siedamgrotzky agrees with him on all points of importance, it is not necessary here to enter into further details.

Regarding the measures to be employed in preventing the spread and in ultimately eradicating the disease, Professor Siedamgrotzky agrees on all principal points with Dr. Bang. He thinks, however, that the effectiveness of the Danish method depends to a large degree on the greater or less understanding on the part of the cattle owners of the fundamental principles of hygiene and their willingness and ability to carry them out. These conditions do exist no doubt to a great extent in Denmark, as evidenced by the splendid results obtained there through Bang's method, and in other places, as proven by the highly satisfactory results reported from certain parts of England and Germany; but to adopt the method in general would, in his opinion, be impracticable. Its success is based upon the voluntary cooperation of the cattle owners with the Government, and this can only be accomplished in places where the cattle owner sees his profit in adopting the method and in overcoming the many obstacles and difficulties which it carries with it. Many of them have entered into the undertaking with actual zeal, but the constant drudge of carrying out the unwonted regulations has sooner or later cooled their enthusiasm. The difficulty in attending to two separate sets of animals, the boiling of the milk for the calves, the passive unwillingness of the attendants, and the ridicule of the neighbors, have made many of them give up the fight before it was well begun. And it must not be overlooked that the method requires considerable pecuniary sacrifices on the part of the owners, which many of them are entirely unable to stand.

For these reasons the voluntary eradication of bovine tuberculosis will never become popular, especially in the larger countries. To show how slight is the inclination of the cattle owners in certain agricultural districts to employ the tuberculin test, it may be mentioned that in Saxony, with its approximately 600,000 head of cattle, only one-half of 1 per cent has been tested annually for the past three

years, and in Bavaria, with 3,500,000 cattle, only one-tenth of 1 per cent has been tested.

Only when the voluntary efforts of the owners are materially supported by the Government, when the expenses of the tuberculin and of the professional services of the examining veterinarian are defrayed by the state, and when eventually the owner will receive indemnity for condemned animals, will the prospects of success be better. Such measures as these are employed in Denmark, Norway, and Belgium, and have yielded good results, although Denmark is the only place where their effectiveness has been proven beyond a doubt. It must, however, be remembered that even under the most favorable circumstances it requires years to eradicate the disease from an infected herd.

On the other hand, we know from experience that in dealing with infectious animal diseases the only reliable means are compulsory sanitary measures. By their aid only have we succeeded in controlling rinderpest, sheep-pox, contagious pleuro-pneumonia, glanders, and other infectious diseases. And as bovine tuberculosis is nothing more or less than an infectious disease its eradication can never be accomplished except through compulsory sanitary measures.

It must, however, be admitted that the difficulties connected with the enforcement of such measures are much greater in dealing with tuberculosis than with any other disease. Its slow course and vague symptoms make it difficult of diagnosis, and even if this were overcome by means of the tuberculin test, we would still, on account of its great prevalence, be barred from the employment of the most effective measure of eradication; that is, the destruction of all affected animals.

As an absolute necessity for success, Siedamgrotzky recommends, first, a general and effective meat inspection. Owing to the nature of the disease it has been found impossible to enforce the compulsory announcement of suspected or decided cases of tuberculosis. But through compulsory meat inspection all cases must necessarily come to notice sooner or later, and it does not seem impracticable to have their origin investigated and to utilize the information obtained in this way as a basis for further action. Only such cases need be looked into where the disease has assumed one of the forms which is considered especially dangerous in the transmission to other animals.

In order to further this project it would seem advisable to form insurance companies for indemnifying all losses resulting from the total or partial condemnation, on account of tuberculosis, of animals killed for consumption. The only point to be insisted on in the formation of such companies would be that *all cattle* would have to be insured; that is, the insurance must be compulsory.

Finally, the following regulations are suggested for the eradication of bovine tuberculosis:

1. All meat inspectors must report every case of tuberculosis which results in total or partial condemnation of the carcass, and all such which are deemed to have been especially effective in disseminating the infection.
2. Investigation as to the origin of the animal in question.
3. Examination of the herd to which it belonged. All cattle showing clinical symptoms of tuberculosis should be branded or otherwise marked.
4. Separation and slaughter in from one to three months of all animals which must be considered dangerous in spreading the disease, under penalty of losing all right to indemnification, but under promise of indemnity in full in case of mistake in the diagnosis.
5. Thorough disinfection of the stable and premises where the affected animals have been kept.
6. Careful removal and destruction of all affected parts of the carcass.
7. Quarterly inspection of all affected herds.
8. Milk from cows with tuberculous mammitis must be used for either man or animal in boiled condition only.
9. Skim milk from cooperative dairies must be returned or sold in sterilized condition only.
10. Absolute destruction of all separator residues.
11. Permanent supervision, in regard to tuberculosis, with all dairies which make a specialty of providing milk for children and invalids.

In connection with the above compulsory measures the Government should encourage the voluntary eradication of tuberculosis (as described above) by supplying tuberculin and providing professional assistance in testing the herds. The importation of cattle, except for immediate slaughter, should be subject to tuberculin test and quarantine at the port of entrance.

In conclusion, the following resolutions were submitted for the consideration of the congress:

Bovine tuberculosis threatens public health and causes enormous and continually increasing losses. Consequently its suppression calls for energetic action, which should consist in the destruction of all animals affected with a dangerous form of the disease and of all suspected calves; the separation, after testing with tuberculin, of all reacting animals, and the raising of the calves on sterilized milk.

Suppression and eradication through voluntary efforts on the part of the owners is no doubt possible, but the method is exceedingly slow and calls for liberal support from the public funds.

Coercive sanitary measures can only be recommended in connection with general meat inspection and with compulsory insurance against losses resulting therefrom on account of tuberculosis; the insurance companies to be subsidized by the state. Such measures, even when enforced with moderation, will prevent the further spread of the disease and ultimately lead to its complete eradication.

Dr. L. Stubbe, chief veterinary inspector for the department of agriculture of Belgium, submitted a paper in which he describes the efforts which have been made in that country for the suppression of bovine tuberculosis. The principle on which the work has been carried on was laid down in an act of August 10, 1897, which makes it compulsory for all veterinarians to report to the respective veterinary

inspectors in their districts every case of bovine tuberculosis observed by them in their practice. The suspected animals are immediately isolated and must, in the course of a week, be passed upon by the veterinary inspector; and in all cases where a positive diagnosis of tuberculosis is arrived at the matter is turned over to the principal local civil authority, whose duty it is to have all such animals destroyed within eight days after they have been brought to his attention. As indemnity the owners receive 70 per cent of the commercial value of the destroyed animals, with a maximum of 420 francs when the flesh is condemned as unfit for human food. When the meat is passed for consumption the indemnity is 25 per cent of the commercial value, with a maximum of 150 francs. In return the owner must comply with the regulations of the above-mentioned order, which makes it compulsory for him to disinfect the premises and to dispose of the carcasses of condemned animals.

In this manner the Belgian Government has, since 1895, paid out more than 829,000 francs in indemnities for about 5,070 animals.

Regarding animals suspected of tuberculosis—that is, such as have been kept with clinically affected animals—it is the duty of the veterinary inspector to have them immediately isolated. If agreeable to the owner, these animals are tested with tuberculin, and if they react they are destroyed, and indemnity paid at the same rate as if they were clinically affected. If they do not react, the expenses of the test are borne by the owner.

According to Dr. Stubbe's opinion, an animal which gives a typical reaction to the tuberculin test is just as dangerous for the propagation of the disease as one that is clinically affected, and consequently he thinks it imperative to dispose of such animals with as little delay as possible.

Between 1892 and 1898 the Belgian Government voted a total of 3,857,000 francs for the eradication of tuberculosis. It would therefore have been natural to look for something more in Dr. Stubbe's paper than a mere statement to the effect that fewer animals are tested with tuberculin at the present time than formerly; but no information is to be found regarding a decrease in the prevalence of the disease during the period 1892 to 1898, so it is impossible to reach conclusions as to the value of the method employed for the eradication of tuberculosis. However, Dr. Stubbe submits for the consideration of the congress the following measures:

1. The compulsory slaughter of (a) all animals clinically affected, and (b) all those which are clinically suspected and which have reacted to the tuberculin test, and the complete isolation of all such animals during the period while awaiting slaughter. Further, that an equitable indemnity be paid to the owner.
2. The owners should be advised to have all animals which have come in contact with such animals as mentioned under paragraph 1 tested with tuberculin. The cost of the test is to be borne by the Government, and at the time of slaughter a special indemnity is to be paid for the animals that have reacted.

3. All animals which have reacted, but which show no clinical symptoms, are to be isolated, and are not to be disposed of except for immediate slaughter. Such animals should not be retained indefinitely, but must be slaughtered within a certain definite period.

4. All skim milk and buttermilk which is returned to the owners from cooperative dairies must have been thoroughly sterilized.

5. The distribution of tuberculin should be controlled by the Government.

6. General meat inspection should be introduced all over the country.

After a spirited discussion, with Dr. Degive, of Brussels, in the chair, and with Siedamgrotzky, Bang, and Stubbe as the principal participants, the following resolutions were adopted.

It is worthy of note that the method of voluntary suppression on the part of the cattle owners was given absolute preference, and that no compulsory measures, as recommended by Siedamgrotzky and Stubbe, were adopted:

1. The suppression of bovine tuberculosis has become an urgent necessity.

2. It is indispensable that the efforts to this effect should be along the line of the voluntary suppression of the disease, which has been proven practical. It requires the earliest possible destruction of all animals affected with any of the dangerous forms of the disease, and careful protection against infection of all healthy animals, especially calves.

The voluntary efforts of the cattle owners should be encouraged and supported by the governments through the dissemination of knowledge regarding the nature of the disease and its manner of transmission, and in reference to the importance of the tuberculin test; also through the appropriation of public funds.

In suppressing tuberculosis among the domesticated animals it is of importance that tuberculin should be employed, as it has been recognized as the best known means of diagnosis for this disease.

The distribution of tuberculin should be under Government control, and in no case should it be available except to veterinarians.

3. The efforts at suppression of bovine tuberculosis should be carried out under government regulations, which, when executed with prudence, will prevent a further spread of the disease and gradually lead to its extermination.

These regulations require: (a) That all veterinarians report officially every case of tuberculosis which comes to their notice, and (b) the destruction without delay of all dangerously tuberculous animals (particularly those affected with tuberculous mammitis, metritis, enteritis, and pulmonary tuberculosis), indemnity being paid from the public funds, and the enforcement of measures forbidding the return of skim milk from cooperative dairies except in sterilized condition.

Below will be found a copy of the other resolutions adopted by the Seventh International Veterinary Congress:

RESOLUTIONS OF THE SEVENTH INTERNATIONAL CONGRESS OF VETERINARY SURGEONS.

I.—*Preventive measures against the spread of epizootics in consequence of international cattle trade.*

The Seventh International Veterinary Congress considers an effective fight against epizootics in the interest of the individual states as well as of the public economical welfare both useful and desirable. The means to be employed are a uniform application of scientific principles and effective regulation of the veterinary service, the intelligence department respecting epizootics, and the international cattle trade.

But the congress, considering the difference in the economical development and the conditions of traffic as well as the dissimilitude of veterinary organization in the separate countries, does not think the moment has yet come for laying down definite principles for an international agreement.

II.—*The prevention of foot-and-mouth disease.*

It is in the interest of an effectual prevention of foot-and-mouth disease:

- (1) By all and every means to prosecute the scientific investigation of this disease.
- (2) To exclude from free traffic all infected districts.
- (3) To submit the traffic in cattle to rigid veterinary police regulations so that no cattle are offered for sale until they have been carefully inspected.
- (4) To prevent the return of skim milk and other by-products from cooperative dairies until they have first been thoroughly sterilized.
- (5) That the local authorities be directed under certain circumstances to cause the slaughter of animals, and that the owners be indemnified for the resulting losses.
- (6) That the veterinary police regulations be uniformly enforced throughout the country, and that especial stress be laid upon the absolute isolation of the infected districts and upon the disinfection of the clothes of the attendants.

III.—*The newest suggestions for an effective meat inspection.*

(1) The congress desires to draw the attention of the governments of the states officially represented to the necessity of the general introduction of compulsory inspection of meat.

(2) Only graduated veterinary surgeons should be appointed meat inspectors. In places where it is impossible to obtain such, specially adapted lay inspectors should be provisionally appointed and given limited authority only. These lay inspectors must have been trained by professional inspectors in the larger slaughterhouses, must have passed an examination, and should, in the exercise of their functions, be under constant supervision of a veterinary surgeon. Positions as professional meat inspector or as director of abattoirs and stock yards are to be filled only by veterinarians.

(3) Instructions in meat inspection at the veterinary colleges should be extended and improved and a practical and theoretical examination in meat inspection should be included in the final examination for the diploma of veterinary surgeon. It is furthermore to be exacted that the candidates should receive at least eight weeks training under one of the official meat inspectors in a large official abattoir.

(4) All meat inspections should be based upon scientific and practical principles approved by international agreement.

(5) The meat inspection should include all classes of animals which are slaughtered for food and should be introduced everywhere. This applies to the meat of all animals which is intended for human food, whether it be for public sale or private consumption.

(6) The perfection of meat inspection is only possible in places where public slaughterhouses exist and where the sanitary regulations compel the slaughter of all animals in the public slaughterhouses. It is, therefore, necessary that such slaughterhouses be erected in as many places as possible.

(7) In regard to the importation of fresh slaughtered meat it is to be demanded—

(a) That the carcasses of cattle and horses be divided into only four parts, those of swine into two parts, while those of all other animals must be undivided.

(b) That the principal internal organs remain attached to the respective parts.

These regulations apply to all meats imported from foreign countries. Preserved meat from foreign countries is to be imported only when prepared and

packed in an absolutely satisfactory manner and when it can be ascertained with certainty that it is harmless.

(8) All inspected meats which are passed for consumption should be plainly marked with either stamps or lead seals.

(9) All meats which, on inspection, are found to be harmless although of inferior quality should be sold under declaration at certain places ("Freibanken") under the supervision of the authorities.

(10) The compulsory insurance, under State supervision, of all animals intended for slaughter is absolutely necessary to render effective the meat inspection and the eradication of infectious diseases.

(11) For scientific and economical purposes, the results of meat inspection are to be collected in systematically arranged statistics, in which international uniformity is to be aimed at.

IV.—*Provisions for a uniform anatomical nomenclature in veterinary surgery.*

The congress approves the recommendations of the nomenclature commission and agrees to expend the necessary funds for the publication of the anatomical nomenclature, or at present the 2,500 marks appropriated for this purpose. Any further means necessary must be obtained from the treasury of the next international congress.

V.—*The prevention of tuberculosis among domestic animals.*

(See resolutions on page 552.)

VI.—*The utilization of the flesh and milk of tuberculous animals.*

OF THE FLESH.

When a general compulsory inspection of all food animals, before and after slaughter, has been inaugurated, the following rules are to be enforced in order to eliminate the dangers which under certain circumstances might result from the consumption of flesh from tuberculous animals:

(1) In examining the carcasses of slaughtered animals it is necessary that all the professional inspectors follow certain rules which will insure that every case of tuberculosis is discovered and that the extent of the tuberculous lesions are ascertained.

(2) Of greatest importance is the unfailing discovery and the careful removal of the affected organs together with their appendages.

(3) When tubercular centers are located in the flesh, the infected regions, as bounded by the surrounding lymph glands, are to be treated in the same way as the infected organs—that is, when it can be ascertained beyond a doubt that infection is limited to a certain region.

When the tuberculous alterations in the meat are confined to the lymph glands located therein, the muscle parts may be dissected away from the bones, joints, blood vessels, and lymphatics, and when cut in small pieces and thoroughly sterilized be offered for sale as food.

In the case of fat animals the melting out of the fatty tissue is allowed when care is taken to remove the tuberculous centers.

(4) In all cases of local tuberculosis, or in such where the generalization is limited in extent and confined to the internal organs, the meat may be offered for sale in raw condition. When, however, the tuberculous processes are of considerable extent, the meat should be sold under declaration.

(5) In all cases where there is pronounced emaciation or symptoms of recent generalization (swelling of the spleen and lymphatic glands or miliary tuberculosis of the spleen, liver, lungs, and kidneys), the whole of the meat, with exception of the melted fat, must be condemned as unfit for human food.

(6) In cases where the local character of tuberculosis and the harmlessness of the meat are doubtful (especially when there are tuberculous caverns and incipient derangement of nutrition), the whole of the meat is to be sterilized before being handed over as fit for food.

(7) The sterilized meat and the melted fat are to be sold under declaration.

OF THE MILK.

(1) Cows, goats, and other animals kept for dairy purposes must be subjected to regular veterinary control.

(2) The milk of tuberculous animals is not to be used for human food if the animals are emaciated or affected with tuberculosis of the udder.

(3) All emaciated animals and those suffering from tuberculosis of the udder should be destroyed without delay, as it is now done in Denmark and Sweden, and the owners indemnified by the State.

VII.—*The prevention of swine epizootics.*

(1) In dealing with the infectious diseases of swine it is necessary that separate veterinary police regulations be provided for swine plague and hog cholera on the one hand and for swine erysipelas (rouget) on the other.

(2) As far as swine plague and hog cholera are concerned, it is recommended to destroy all the affected and suspected animals and to disinfect the premises where they have been kept. This measure is especially recommended when the diseases appear in a hitherto uninfected locality. The effectiveness of preventive inoculation has not yet been sufficiently demonstrated and its use can be recommended only in districts where the diseases have become stationary.

(3) In combating swine erysipelas it is advisable to vaccinate all the animals which have been exposed to the infection and to place the infected herds under veterinary police supervision.

It is also desirable that vaccination be made obligatory in all localities where the disease appears regularly.

VIII.—*The extension of veterinary instruction.*

The congress resolves:

(1) That the students of veterinary medicine ought to possess the certificate of university maturity.

(2) That the duration of the studies ought to be at least eight terms.

(3) That veterinary instruction be given a more practical direction.

(4) That the study of veterinary medicine ought to extend to all animals useful in agriculture.

(5) That there be created in connection with every veterinary school a sanitary institute for the instruction and experimental study of the etiology and prevention of diseases, and particularly of epizootics.

(6) That the instruction in meat inspection requires a special course of a practical character in a public slaughterhouse.

IX.—*Determination of the time and the place of the eighth congress.*

The next congress will take place in 1905 at Budapest. The members of the seventh congress that have come from the said city will be intrusted with the organization of the eighth, and they are hereby authorized to select and appoint members for the committee on organization.

NOTES ON PARASITES—50-52.¹

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AND

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Since the publication of Bulletin 19, "The inspection of meats for animal parasites," in 1898, three flukes (trematodes), not mentioned in that work as having been found in the food animals of the United States, have been forwarded to the Zoological Laboratory by inspectors of this Bureau.

One is an immature fluke (*Agamodistomum*) encysted in the muscles of hogs and found by the trichina inspectors. It is of no known medical or hygienic importance. (See p. 559.)

The second is a "lung fluke" belonging to the genus *Paragonimus*, family Fasciolidae. It was found encysted in the lungs of swine, and appears to be identical with the lung fluke which causes parasitic hæmoptysis in man in Asia. The attention of both the veterinary and the medical professions of the country is called to this parasite. To the veterinarian it is of importance, not only from a standpoint of public hygiene, in meat inspection, but also from a standpoint of practice. Its presence will explain certain cases of coughing, expectoration of blood, and epileptiform attacks which may possibly be observed among swine. To the physician it is of importance because of its influence on human subjects in causing various symptoms—coughing, expectoration of blood, anemia, disturbance in vision, cortical epilepsy—symptoms none of which are found in this disease alone. The medical aspect of the parasite becomes doubly important for American physicians, now that so many American troops are seeing temporary service in the East; they may contract the disease in Asia and continue to suffer from it after returning to this country. (See p. 560.)

¹ A bibliography of Notes on Parasites 1 to 31 may be found in the *Veterinary Magazine*, 1895, II, pp. 225-228.

The third parasite referred to is the conical amphistome (*Amphistoma cervi*) from the rumen of cattle. (See p. 611.)

50: A MUSCLE FLUKE (*Agamodistomum* sp.) IN AMERICAN SWINE.

On pp. 29, 30, fig. 1, of Bulletin 19, mention was made of an agamic distome found in Europe in the muscles of hogs. Several times similar parasites have been reported to us by the trichina inspectors of this Bureau, and on two occasions specimens have been forwarded. In no instance, however, have we been able to examine material upon which we should be willing to make any definite statements regarding the exact systematic position of the parasite in question. All that could be definitely determined was that an encysted agamic distome was present in the muscular tissue. Whether the worm was specifically identical with the form (*Agamodistomum suis*) found in Europe by Leunis is a question which can not be definitely settled, but it does not seem improbable that such is the case. It appears equally probable, however, that the American worms may be young specimens of the lung fluke (*Paragonimus Westermanii*), discussed below, which have accidentally reached the muscles. There is, however, no record that the hogs which contained these agamic forms also harbored lung flukes.



FIG. 23.—The muscle fluke (*Agamodistomum suis*) occasionally found in the muscle of swine. After Leuckart, 1889, fig. 86, p. 155.

Mr. Charles Bullard, when in charge of the microscopic inspection for trichinae at Buffalo, N. Y., reported regarding the worm as follows:

January 11, 1900. "The interesting little pork muscle fluke was found in a slide prepared for trichina inspection. My attention was probably attracted to the rather small worm by the numerous fat or oil bodies inside, resembling somewhat those bodies in *Cleptis* (a small leech) on which I did some work last year. The dates on the slides, although slight evidence, would indicate a more common occurrence than suspected at present; and no doubt, could steps be taken, a grand series could be gathered in from the stations, and rather definite knowledge as to kinds or stages be made out.

"The individuals so far collected were each encysted in a conspicuous characteristic cyst of varying size. Two are sent with these, but I have seen many much larger cysts. These will serve, however, to show the curious recesses or niches in which the parasite resides. I may say in passing that Leuckart's figure, as given in the cut in Bulletin 19 (see above fig. 23), is very inadequate in this regard. And the 'mature' specimen (December 28) indicates that the excretory system is figured somewhat diagrammatically.

"Of course, as each case was found I examined the remainder of the sample for more, but have found nothing so far."

March 12, 1900. "Since my last communication on the subject of muscle fluke, no actual flukes have been seen. However, a number of doubtful cases have been looked up, and a large number of preparations examined for further evidence from each case. At no time has the slightest trace of a cyst or fluke been thus found. In all the previous cases of muscle fluke a conspicuous cyst inclosed the worm, which makes it practically certain that no cyst has been passed in the preparations examined by the microscopical force since the first fluke was found."

Abattoir inspection.—The worm will be noticed only upon microscopic examination of the muscles; hence it will escape detection by the killing-floor inspectors and be found only by the trichina inspectors. There is at present no ground for assuming that the parasite is transmissible to man; neither is it evident that the worm causes any noteworthy alteration in the muscular tissue which would render the pork unfit for food. Accordingly, so far as our present knowledge goes, this parasite would not be any more important from a standpoint of meat inspection than are the Sarcosporidia (*Sarcocystis Miescheri*) found in hogs, and hence there would appear to be no necessity for condemning the meat. Even if it should be demonstrated that this is a young *Paragonimus Westermanii* and that it represents the infecting stage, ordinary curing or cooking would undoubtedly kill the worm, thus rendering the meat perfectly safe as food.

51: THE LUNG FLUKE (*Paragonimus Westermanii*) IN SWINE AND ITS RELATION TO PARASITIC HÆMOPTYSIS IN MAN.

[Figs. 24 to 28 and Pls. XXIII-XXIV; figs. 1-4.]

A number of specimens of lung flukes, taken from hogs (see p. 600) in February, have been forwarded by Dr. A. J. Payne, Bureau of Animal Industry, inspector in charge at Cincinnati, Ohio.

As nearly as we can determine at present, the worm is specifically identical with the lung fluke known under the various names of *Distoma pulmonale*, *D. Ringeri*, and *D. Westermanii*, for which Braun has recently erected a new genus *Paragonimus*. *Paragonimus Westermanii* (this being the correct binomial for the worm) was originally described by Kerbert in 1878 from the lungs of a tiger which died in Amsterdam. A similar parasite was afterward found in man in Japan by Baelz and in Formosa by Ringer, and, though originally supposed

DESCRIPTION OF PLATE XXIII.

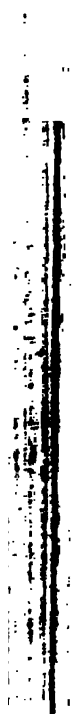
The lungs of a hog, showing the cysts caused by infection by lung flukes (*Paragonimus Westermanii*). Reduced. Original.

DESCRIPTION OF PLATE XXIV.

1. A portion of hog's lung, containing a lung-fluke cyst, which is here cut open. Original.
2. Six lung flukes (*Paragonimus Westermanii*) from hogs. Drawn from life; natural size and color. Original.
3. Content of a lung-fluke cyst, containing eggs of the lung fluke. Greatly magnified. Original.



LUNGS OF SWINE INFECTED WITH FLUKES.





2



Wm. H. Dall

LUNG FLUKES OF SWINE.

AMERICAN JOURNAL OF ANATOMY, 1899, 2, 1



to represent a new species, it is now generally admitted to be identical with Kerbert's form from the tiger. Railliet (1890) afterwards reported the same parasite from the dog in Japan, having examined some specimens in the Japanese department of the Paris Exposition of 1889; Ward (1894A) reported it for the cat in the United States, and later (1895A) he determined, as identical with this species, certain undetermined distomes which Kellicott (1894) had reported from a dog in Ohio. The present article is the first in which this lung fluke is recorded for hogs.¹

Referring to its systematic position, this parasite has always been placed in the family Fasciolidae. Originally it was placed in the collective genus *Distoma*. Later it was transferred to *Mesogonimus*, which latter name was afterward suppressed in favor of *Clinostomum*. Blanchard (1891) recognized that the species in question was scarcely congeneric with the other members of the genus *Mesogonimus*, while Stiles & Hassall (1898, pp. 86, 96) and MacCallum (1899, p. 708) indicated its disagreement with the type species of *Clinostomum* and intimated that this genus should be divided. Braun (1899) proposed for *D. Westermanii* the new genus *Paragonimus*, where it should now be

¹Since reading the proof of this article we have received a copy of Vol. I, fifth edition, Friedberger & Fröhner (1900, p. 352), and notice the words: "*Distomum pulmonale* in hogs, dogs, and cats (Japan)." It would appear from this that we are not the first to record this parasite in hogs. Who found the worms in hogs and cats in Japan we have not been able to trace, but the fact that it has been reported also in these two hosts in that country supports still further the view that our American form is identical with the Asiatic worm (see p. 566), and renders it practically positive that cases of infection of man in America will be found.

Another reference which had escaped us is Janson (1892, p. 64), who states that "*Distomum pulmonale*" was found twice in dogs by Professor Tokishige; the worms were free in the bronchi. Janson also says that "these parasites are so common, especially in southern Japan, that in some places 25 per cent of the inhabitants are alleged to be infested with them."

It may also be added that the Rev. Joseph Clos, S. J., who has recently come from Manila, has stated to us in conversation that he has known of a number of cases of hæmoptysis, especially among the natives, in the Philippines. He had, however, never investigated the cause of this blood spitting.

FRIEDBERGER, FRANZ, und FRÖHNER, EUGEN.

1900.—Lehrbuch der speciellen Pathologie und Therapie der Hausthiere, für Thierärzte, Ärzte und Studirende. 5th Ed. Bd. I, pp. xvi, 867, 8". Stuttgart.

[p. 352: "*Distomum pulmonale* in hogs, dogs, and cats (Japan)."]

JANSON, J. L., und TOKISHIGE, H.

1892.—*Filaria immitis* und andere bei Hunden in Japan vorkommende Parasiten <Mitteil. d. Deut. Ges. f. Natur- u. Völkerkunde Ostasiens in Tokio, V (Heft xlviii), May, pp. 349-360, Taf. xi-xii.

[pp. 349, 351: "*Distoma pulmonale*."] [Reprinted as —]

JANSON [J. L.]

1892.—*Filaria immitis* und andere bei Hunden in Japan vorkommende Parasiten <Arch. f. Wiss. u. Prakt. Thierheilk., XVIII, pp. 63-79.

[p. 64, 65: "*Distomum pulmonale*" found twice in dogs by Tokishige.]

placed. Looss was not aware of the genus *Paragonimus* when he proposed *Polysarcus*.

The generic synonymy and diagnosis stand as follows:

Genus PARAGONIMUS Braun, 1899.

1899, December 11: *Paragonimus* BRAUN, 1899, p. 492. Type, *Distoma Westermanii* Kerbert, 1878.

1899, December 30: *Polysarcus*¹ LOOSS, 1899, pp. 560, 561. Type, *Distoma Westermanii* Kerbert, 1878.

¹ Not: *Polysarcus* Fieb., 1853, orthopteron; *Polysarcus* Sauss., 1859, orthopteron; *Polysarcus* Lef., coleopteron; *Polysarca* Schin., 1866, dipteron.

In the same paper Looss proposes several generic names as new which are preoccupied. To this fact we have already called his attention, and he has signified his intention to make the necessary alterations. The following homonyms should be noticed:

Astia Looss, 1899, pp. 590, 591; type, *renifera*. Not *Astia* Koch, 1879, arachnid.
Anadasmus Looss, 1899, pp. 568, 569; type, *amphiorchis*. Not *Anadasmus* Washington, 1897, insect.

Baris Looss, 1899, pp. 669, 670; type, *proteus*. Not *Baris*, Germ., 1817, coleopteron.
Creadium Looss, 1899, pp. 570, 571; type, *isoporum*. Not *Creadion* Vieill., 1819, bird; also written *Creadium*.

Enodia Looss, 1899, pp. 592, 593; type, *megachondrus*. Not *Enodia* Hübner, 1819, lepidopteron, nor *Enodia* Dalb., 1843, hymenopteron.

Leptalea Looss, 1899, pp. 627, 628; type, *exilis*. Not *Leptalea* Klug, 1839, hymenopteron.

Megacetes Looss, 1899, pp. 630, 631; type, *triangularis*. Not *Megacetes* Thomas, 1859, coleopteron.

Microscapha Looss, 1899, pp. 668, 669; type, *reticularis*. Not *Microscapha* Le Conte, 1866, coleopteron.

Stomylus Looss, 1899, pp. 629, 630; type, *singularis*. Not *Stomylus* Fahr., 1877, coleopteron.

Opinion will differ regarding the following cases, but we hold that Looss's names are available. In some cases, however, they are not valid, as they are antedated by other names:

Acanthostomum Looss, 1899, pp. 577-579; type, *spiniceps*. Not to be confused with *Acanthostoma* Krichbaumer, 1895, insect.

Dolichosomum Looss, 1899, pp. 562, 563; type, *lorum*. Antedated by *Itygonomus* Lühe, 1899; type, *lorum*. Not to be confused with *Dolichosoma* Steph., coleopteron.

Hæmatolæchus Looss, 1899, pp. 600-604; type, *variegatus*. Not to be confused with *Hæmatolæcha* Stål, 1874, coleopteron.

Lepoderma Looss, 1899, pp. 589, 590; type, *ramlium*. Antedated by *Plagiorchis* Lühe, 1899; type, *lima*. Not to be confused with *Lepidoderma* Zelinka, 1889, worm.

Liopyge Looss, 1899, p. 642; type, *Bonniéri*. Not to be confused with *Liopyge* Lewis, 1891, insect.

Progonus Looss, 1899, p. 643; type, *Mülleri*. Not to be confused with *Progone* Berg, 1852, lepidopteron.

Psilostomum Looss, 1899, pp. 573, 574; type, *platyurum*. Not to be confused with *Psilostomata* [not a generic name!] Sow., mollusks.

Stephanostomum Looss, 1899, p. 576; type, *cesticillus*. Not to be confused with *Stephanostoma* Daniellssen & Koren, geophyrea.

Attention may also be called to the following new generic names:

GENERIC DIAGNOSIS.—Fasciolidae: Body medium large, thick, elongate, frequently oval, and on cross section more or less round, usually somewhat attenuate toward posterior extremity. Cuticle provided with scale-like spines. Intestine with strong, somewhat elongate pharynx; very short oesophagus; intestinal caeca zigzag, extending to caudal end of the body. Median excretory stem (or bladder) large dorso-ventrally, irregular in outline, and extending cephalad to near the pharynx. Genital pore near caudal margin of ventral acetabulum, in median line or to the right or left. Copulatory organs (cirrus) absent. Testicles¹ round (?) or branched, in posterior half of body, one each side of median line and one slightly posterior to the other. Ovary somewhat branched, the branches being thick and short, and the organ located postero-lateral of the ventral acetabulum, on the side (right or left) of the median line opposite to the main portion of the uterus. Receptaculum seminis absent; Laurer's canal present. Vitellaria enormously developed, extending from anterior to posterior end of the body and



FIG. 24.—Ventral view of a compressed specimen of a lung fluke from a hog. Greatly enlarged. Original.

- Ctenogonimus* Looss, 1899, pp. 585, 586, 619; type, *heterophyes*. Antedated by *Cotylogonimus* Lühe, 1899; type, *heterophyes*. This in turn is antedated by *Heterophyes* Cobbold, 1866 [probably earlier]; type, *heterophyes*.
Heterolepe Looss, 1899, pp. 551, 651, 652, 653, 655; type, *leptostomum*. Antedated by *Harmostomum* Braun, 1899; type, *leptostomum*.
Prymnoprion Looss, 1899, pp. 628, 629; type, *ovatus*. Antedated by *Prosthogonimus* Lühe, 1899; type, *ovatus*.
Spathidium Looss, 1899, p. 605; type, *folium*. Antedated by *Phyllodistomum* Braun, 1899; type, *folium*.
Telorchis Looss, 1899, pp. 566-569, 614; type, *Linstowi*. Antedated by *Telorchis* Lühe, 1899; type, *clava*.

¹ Cobbold's figure of *P. compactus*.

located (as seen in cross section) on the periphery, usually leaving a longitudinal free space both in the dorsal and ventral median field. The transverse vitello-ducts pass cephalad of the testicles, but caudad of ovary and uterus. Uterus may be only slightly developed or may form a comparatively large-sized rosette, more than half as broad as the body. It may be located entirely on one side (right or left) of median line or may extend both sides of median line, partially covering the ovary. Eggs rather large, about 80 to 118 μ long by 48 to 60 μ broad. Embryo develops after oviposition.

HABITAT.—Encysted, usually two in each capsule, in lungs of mammals.

TYPE SPECIES.—*Paragonimus Westermanii* (Kerbert, 1878).

Looss recognized only one species for this genus, but Braun recognized three—*Westermanii*, *compactus*, and *rudis*. Cobbold (1859, p. 140) states that the parasite which he described as *Distoma Ringeri*,

from the lungs of man in Formosa, reminded him of *Distoma compactum*, described in 1859 from the lungs of an Indian ichneumon (*Viverra mungos*=*Herpestes mungo*, the mongoose), but that the two forms are undoubtedly distinct.

An examination of Cobbold's description (1859, p. 363, tab. 63, figs. 1-3) shows that *Distoma compactum* is quite closely allied to, certainly congeneric with, *Paragonimus Westermanii*; it should therefore now be known as *Paragonimus compactus*.

Leuckart compared Kerbert's specimens of *D. Westermanii* from the tiger with specimens of *D. pul-*



FIG. 25.—Ventral view of a lung fluke from man showing anatomy. ac, acetabulum; ex. c., excretory canal; i, intestinal caeca; ov, ovary; t, testicles. After Leuckart, 1889, fig. 182, p. 405.

monale from man, and gave the positive assurance that they were specifically identical, an opinion in which Nakahama concurred. So far as we are aware, no actual comparison of the Japanese specimens from the dog with specimens from man has yet been made by any zoologist. Likewise, no actual comparison of any of the American specimens from the dog, cat, or hog has as yet been made with any Asiatic specimens from man, tiger, or dog; but neither Ward nor we have felt justified, so far as we could judge from descriptions, in

maintaining that the American lung fluke is specifically distinct from the Asiatic worm.

It will be noticed that the specimens first found were from the genus *Felis* (the tiger); also that Ward's first case came from a member of the same genus (the domesticated cat). There is nothing strange in finding the same parasite in these two hosts. In fact, except for the habitat of the hosts (Asia and America), the same parasites might be expected in these two animals. It is by no means inconceivable, however, that the parasite was introduced from Asia to America by some animal—a tiger or perhaps a man—and, finding here the conditions necessary for its development, it infected a cat.

Ward's determination of *Paragonimus Westermanii* in a dog in Ohio (Kellicott's specimens) need not excite surprise, since

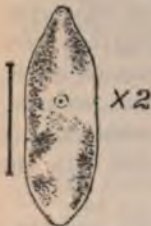


FIG. 27.—Figure of one of Ward's specimens from a cat. After Stiles, 1894.

the same parasite is reported for dogs in Japan, and furthermore, since the parasites of dogs and cats are in general quite similar.

Even if it should eventually be shown that the American specimens are distinct from the Asiatic, still, in case the form found in dogs in Japan is actually identical with the form found there in man, there is reason to assume that the species found in the dog by Kellicott will also be able to develop in man. That man may harbor the same parasite as cats and dogs is supported by the fact that this particular worm is reported in Japan both for man and dogs, as well as by the fact that certain feline and canine parasites are also parasitic in man (*Coccidium bigeminum*, *Ascaris*, *Dipylidium*).

As for the hog, it must be confessed that we were rather surprised to find this new host for a worm which we have not as yet been able to separate definitely from *Paragonimus Westermanii* of tigers, dogs, cats, and man. In comparing the other parasites of hogs with those of the other animals mentioned,



FIG. 28.—Dorsal view of a lung fluke from man showing ovary, shell gland, vitellaria, and Laurer's canal. After Leuckart, 1889, p. 185, fig. 4:8.



FIG. 29.—Egg of the lung fluke from man containing a ciliated embryo.

it may be recalled that it appears to be an open question with many authors as to whether *Ascaris lumbricoides* of man is specifically identical with *A. suilla* of hogs. *Trichinella spiralis* is known for man, dogs, cats, and hogs, but not yet, so far as we are aware, for *Felis tigris*, though there can scarcely be a doubt regarding its ability to develop in that host.

From these few comparisons it may be seen that, so far as it can be judged from the present knowledge of parasites, there appears to be no a priori reason for claiming that *Paragonimus Westermanii* could not occur in all the hosts mentioned, and it need excite no surprise if the forms recorded in the various hosts are not only specifically but also varietally identical.

As perhaps a more apparent than real argument against the view that our American form is identical with the Asiatic, may be advanced the assertion that up to the present time this parasite has not been reported from man in this country, nor has it been reported from hogs in Asia. (See p. 561.) Such an argument is, however, purely negative. If it referred to different stages of the same parasite (as an absence of *Balbiana gigantea* in American sheep, but presence of *Sarcocystis tenella*, as an argument against the alleged specific relations of these two forms), the statement could be given more weight.

It may be admitted that both Ward and we have noticed some points in which our American specimens differ slightly from the published characters attributed to the Asiatic worm, and both of us have considered the possibility that our worms may represent a distinct variety, at least. Until an actual comparison of specimens can be made, however, the writers of this paper see themselves forced into the position of a possible zoological error, and feel compelled to continue for the present to look upon the American form as identical with the Asiatic.

This theoretical systematic point is one of considerable practical importance, for if it could be asserted that the Asiatic and the American parasites were specifically distinct, and that the form found in dogs in Japan is not identical with the form found in man, assurances could at once be given that there were no present grounds for fearing that the parasites which Ward found in the cat, Kellicott in the dog, and Payne in the hog, would also be liable to infect man in this country. So long, however, as such proof can not be brought forward, we must admit not only the possibility but also the very great probability that there exists here in America a trematode parasite in our dogs, cats, and hogs which may also attack man.

Thus we prefer to run the risk of a technical zoological error rather than to assume the responsibility of a more serious and more practical hygienic error by giving assurances which at any moment may be

proved to be unfounded. It is therefore our opinion that we must for the present look upon the Asiatic parasitic hæmoptysis, or pulmonary distomatosis, of man as one of the conditions which must be considered in connection with other diseases of man already established in this country. With this view in mind, let us turn to the synonymy and specific characters of the parasite in question.

In connection with the specific name, it may be noted that its correct form is *Paragonimus Westermanii*¹ (not *Westermanni*, as almost universally written); by the rules of zoological nomenclature this name and this alone is valid. All such names as *Distoma pulmonale*, *D. pulmonis*, *D. cerebrale*, *D. Ringeri*, etc., should be used only in quotations or in referring to quotations.

PARAGONIMUS WESTERMANII (KERBERT, 1878) STILES & HASSALL, 1900.

- 1878: *Distoma Westermanii* KERBERT, 1878, pp. 271-273.—JAKSCH, 1897, pp. 129, 130.
- 1880, August: *Distoma Ringeri* CORBOLD, 1880, pp. 139, 140, Pl. x, figs. 1-3.—MANSOON, 1881A, pp. 10-12, figs. 1-9.—Id., 1881B, pp. 8, 9.—Id., 1882A, pp. 55-62, figs. 1-25.—Id., 1882B, pp. 42-45.—Id., 1883A, pp. 134-138, 138-156, Pls. VIII, IX.—Id., 1883B, pp. 532-534.—Id., 1883C, p. 1813.—Id., 1886, p. 241-244.—SONSINO, 1884, pp. 17-21.—TAYLOR, 1884, p. 44-48, fig. 1.—RAILLIET, 1885, p. 296.—BLANCHARD, 1888, pp. 627-630, fig. 326.—IJIMA, 1889, p. 148.—YAMAGIWA, 1891D.—DUNGLISON, 1893, p. 338.—MOSLER & PEIPER, 1894, p. 178.—COPLIN, 1898, pp. 339, 340.
- 1880, September: *Gregarina pulmonum* BÄELZ, 1880, pp. 721, 722.—The Lancet, 1880, II, pp. 548, 549.—BONIS, 1882, p. 148.
- 1880, September: *Gregarina fusca* BÄELZ, 1880, pp. 721, 722.—The Lancet, 1880, II, pp. 548, 549.—BONIS, 1882, p. 148.
- 1881, July: "*Distomum Westermani* Kerbert, 1878" in KERBERT, 1881, pp. 529-578, Taf. XXVI, XXVII.—POIRIER, 1885, pp. 26, 27, 149.—VON LINSTOW, 1889, p. 14.
- (1881): *Distoma pulmonis* KIYONA, SUGA & YAMAGATA (1881), after Ijima, 1889, p. 148, and Yamagiwa, 1891 [not verified].
- (1881): *Distomum pulmonis* KIYONA, SUGA & YAMAGATA (1881), after Yamagiwa, 1892, pp. 446-456 [not verified].
- 1883, April: *Distoma pulmonale* BÄELZ, 1883, pp. 236, 237, fig. 3.—REMY, 1883, pp. 525-527, fig. 2.—TAYLOR, 1884, pp. 44-48, 51, 52, fig. 1.—OTANI, 1888C.—VINCENT, 1889, p. 184; 1890, p. 80.—Id., 1890, pp. 189, 190.—Rev. sci., 1890, p. 189.—YAMAGIWA, 1890, p. 447-460, Taf. XI, figs. 1-3.—Id., 1891A.—RAILLIET, 1890, p. 143.—MOSLER & PEIPER, 1894, pp. 178, 179.—HUBER, 1896, pp. 576, 577.—SIMON, 1896, p. 225.—Id., 1897, p. 209, 224, 259.—WOOD & FITZ, 1897, p. 336.—VIERORDT, 1898, p. 158.

¹ Opinion will differ as to whether *Westermanii* or *Westermani* should be used. The worm was named after Westerman, hence Kerbert should have used, according to present rules, the term *Westermani*; instead of this he originally used *Westermanii*. Those authors who allow emendation may be inclined to accept *Westermani*, while those who do not recognize emendation will accept *Westermanii*, the genitive of *Westermanius*. Our own position is to accept the original spelling of names, totally regardless of euphony, philology, or any other considerations, except evident typographical errors. By this method alone do we see an outlook for finality.

- 1883: "*Distoma pulmonar*," La Clinica de Malaga, 1883, p. 308.
- 1884: *Distoma pulmonum* TOMONO HIDEKATA, 1883.—RIUSAI, 1884.—YAMAGIWA & INOUE, 1890A.—ID., 1890B.—OTANI, 1890.
- 1889: "*Distoma hepaticum*" Linn., misdet. of MIURA, 1889, p. 317.
- 1889: "*Distomum Ringeri* Cobbold & Manson" of VON LINSTOW, 1889, p. 3.—BRAUN, 1893, pp. 876, 877, 882.—RAILLIET & MAROTEL, 1898, p. 31.
- 1889: "*Distomum Westermanni* Kerbert, 1878" of LEUCKART, 1889, pp. 404, 408, 409.—BRAUN, 1892, pp. 586, 588, 589, 597, 602, 604, 605, 607, 622, 628, 644, 654, 664, 665, 666, 668, 669, 671, 675, 677, 679, 682, 699, 700, 701, 703, 705, 707, 711, 712, 713, 715, 717, 718, 719, 723, 724, 725, 727, 728, 730, 733, 735, 736, 752, 753, 758, 784, 785; 1893, pp. 876, 882.—ID., 1895, pp. 142, 143, fig. 58.—SONSINO, 1896, pp. 297, 302.—MONIEZ, 1896, pp. 86, 144-152.—PRATT, 1898, p. 361.—WEICHELBAUM, 1898, p. 315.—MACCALLUM, 1899, p. 708.
- 1889: "*Distomum pulmonale* Baelz, 1883," of LEUCKART, 1889, pp. 404-440, figs. 181-190.—BRAUN, 1892, pp. 664, 758; 1893, pp. 876, 882.—MONTICELLI, 1893, pp. 13, 33, 35, 38, 39, 83, 87, 95, 102, 105, 106, 107, 155, 157.—KHOLODKOWSKI, 1898, pp. 26, 31, Pl. XI, figs. 18-21.—WEICHELBAUM, 1898, p. 315.—GAMBLE, 1896, pp. 63, 70.—SCHNEIDEMÜHL, 1896, pp. 301, 302. (See also p. 561.)
- 1890: *Distomum cerebrale* YAMAGIWA, 1890, p. 457.
- 1890: "*Distoma Ringers*," misprint in Rev. sci., 1890, XLVI, pp. 189, 190.
- 1890: "*Mesogonimus Westermanni* (Kerbert, 1878)" RAILLIET, 1890, p. 143.—ID., 1893, pp. 369, 370.—BLANCHARD, 1895A, pp. 739, 740.—ID., 1895B, pp. 34-39.
- 1890: *Mesogonimus pulmonalis* (Baelz, 1883) RAILLIET, 1890, p. 143.—MONTICELLI, 1893, p. 156.
- 1890: *Mesogonimus Ringeri* (Cobbold, 1880) RAILLIET, 1890, p. 143.
- 1891: "*Distoma Westermanni* Kerbert, 1878," of WEBER, 1891, p. LXXXIII.
- 1891: "*Distoma Westermanni* Baelz, 1878," of BLANCHARD, 1891, pp. 610, 611.—WARD, 1894A, pp. 355-357.—ID., 1894B, pp. 362-364.—ID., 1895A, pp. 87-89.—ID., 1895B, pp. 236-239, figs. 1-3.—STILES & HASSALL, 1898, p. 96.
- 1892: "*Mesogonimus pulmonale* (Baelz, 1878)" STOSSICH, 1892, pp. 32, 33.—MONTICELLI, 1893, pp. 83-89.
- 1894: "*Distoma* (*Mesogonimus*) *Westermanni* Kerbert, 1878," of STILES, 1894A, pp. 57, 58, Pl. v, figs. 1-4.—ID., 1894B, pp. 358-360.—ID., 1894C, pp. 107-110, figs. 1-4.
- 1894: *Distomum* sp. of KELLICOTT, 1894, pp. 123-126.
- 1897: "*Distomi Ringeri*," misprint in SIMON, 1897, p. 259.
- 1900: *Paragonimus Westermanii* (Kerbert, 1878), STILES & HASSALL, 1900, pp. 560-611, figs. 24-28, Pls. XXIII, XXIV, figs. 1-4.

SPECIFIC DIAGNOSIS.—*Paragonimus*: 8 to 16 mm. (after Kellicott 15 to 20 mm.) long, 4 to 8 mm. broad, 2 to 5 mm. thick; plump, pinkish to reddish brown (alive) or slate (preserved) in color; live specimens are depressed and with variable outline; preserved specimens often oval to elongate pyriform, transverse section round or nearly so, anterior end bluntly rounded, posterior end less blunt. Oral sucker 0.53 to nearly 0.75 mm. (Leuckart) or more (0.864 by 1.017 mm. or 1 to 1.4 mm.¹ (Ward); or 0.80 to 1.12 by 0.80 to 0.83 mm. (Stiles & Hassall) 0.78; (Kerbert) in diameter, terminal or subterminal in different specimens from the same lung. Ventral acetabulum (0.6 to at most 0.75 mm.—Leuckart; 0.78 mm.—Kerbert; 0.75 to 1.017 mm.—Ward; 0.88 to 1.2 by 0.86 to 1.44 mm.—Stiles & Hassall) very slightly larger than oral sucker; situated somewhat anterior to middle of the body, 2 to 4 mm. back of oral sucker. Cuticle provided with broad

¹ Suckers distorted, measurements not exact.—Ward.

scale-like spines.¹ Genital pore, often indistinct, close to the caudal margin of ventral acetabulum, may be in the median line or immediately to the right or left of it.² Pharynx elongate; oesophagus very short, so that the bifurcation of the intestine is considerably anterior to the ventral acetabulum; intestinal caeca usually somewhat zigzag, some distance from each other, run irregularly to posterior extremity. *Male organs*: Cirrus and cirrus pouch absent; ductus ejaculatorius straight; testicles tubular, ramified, one slightly posterior to other, on each side of median line. *Female organs*: Ovary branched, lateral, right or left of median line, somewhat posterior to acetabulum and antero-ventral of transverse vitello-duct; on the opposite side of median line, at about the same height, is situated a lobate shell-gland and a rather short, massed uterus; in some specimens the latter may spread across the median line and partially cover the ovary; folds of uterus extend ventrally of shell gland; vitellogene glands marginal, highly developed, extending from anterior to posterior extremity, often leaving but a small portion of the dorsal and ventral median field uncovered; transverse vitello-ducts dorsal; vitelline reservoir large; Laurer's canal present. Eggs oval, 80 to 100 μ long by 56 μ broad (Leuckart); 96 to 118 μ long by 48 to 53 μ broad (Ward); 68 to 96 μ long by 48 to 60 μ broad (S. & H.); yellow shell. Miracidium ciliated, develops after eggs leave the host. Sporocyst, redia, cercaria, and intermediate host not known.

TABLE OF HOSTS.

Host.	Locality. ¹	Collector.	Authority. ²
Royal tiger (<i>Felis tigris</i>).....	Amsterdam, Holland	Westerman	Kerbert, 1878, p. 271.
Royal tiger (<i>Felis tigris</i>).....	Hamburg, Germany	Bolau	Kerbert, 1881, p. 529.
Royal tiger (<i>Felis tigris</i>).....	.....	.....	Weber, 1891.
Cat (<i>Felis domestica</i>) ¹	Ann Arbor, Michigan	Ward	Ward, 1894A, p. 362.
Dog (<i>Canis familiaris</i>).....	Japan	? [At Paris Ex- position].	Railliet, 1890, p. 143.
Dog (<i>Canis familiaris</i>).....	Columbus, Ohio, U. S. A.	Kellicott.....	Ward, 1895A, p. 87.
Hog (<i>Sus scrofa domestica</i>) ¹	Cincinnati, Ohio, U. S. A.	Payne.....	Stiles & Hassall, 1900, p. 560.
Man (<i>Homo sapiens</i>)	Formosa, China	Ringer	Cobbold, 1880, p. 139.
Man (<i>Homo sapiens</i>)	Japan	Baelz	Manson, 1881, pp. 10-12.
Man (<i>Homo sapiens</i>)	Korea	Baelz.....	Baelz, 1883, pp. 234-238.

¹ See also geographical distribution of the disease, p. 580.² See also medical discussion and historical review, pp. 578-600.

LIFE HISTORY.—The complete life cycle of the lung fluke has not yet been experimentally demonstrated. According to our present knowledge, the egg does not develop until it leaves the host in the sputum.

Segmentation.—Kerbert (1881, p. 576) reports a segmentation of the ovum to the gastrula stage in the uterus, and Manson (1882A) states

¹ Largest in middle of the body, after Leuckart, but largest on anterior portion, after Kerbert; smallest around mouth, after Stiles & Hassall.² The character attributed to this species relative to the situation of the genital pore on the left of the lateral line would appear to be somewhat diagrammatic; we have found it median, right or left, in specimens from hogs, and Kerbert reports it median.

that (apparently in eggs in the sputum) once or twice he saw "attempts at yolk cleavage, a dozen or more elongated cell-like bodies with a bright nucleus in each occupying the whole of the interior of the egg; but never anything more advanced than this." Kellicott (1894) even goes so far as to conclude that very many of the eggs in the dog he had examined had hatched, since the shells were empty, and one end been removed in the characteristic manner. Leuckart (1889, p. 436), on the other hand, has expressed the view that Kerbert has fallen into error in his observations, and that what he looked upon as a segmentation represented in reality the cells from the yolk glands and not the ovarian egg; at least Leuckart was unable to find any segmentation in the specimens he examined. Manson's observations are possibly to be explained by assuming the same error of interpretation. Referring to Kellicott's interpretation, it may be mentioned that for a trematode egg to develop through segmentation to the larval stage in the tissues of its host would indeed be both interesting and unexpected. At the same time, it can not be stated at present that such procedure is an absolute impossibility. Neither the observations of alleged segmentation recorded by Kerbert and by Manson nor the supposed complete development to the miracidium assumed by Kellicott are beyond conception, for the unexpected not infrequently happens with parasites; still, if the embryo had actually developed and escaped, as assumed, one would naturally expect that Kellicott could have found other eggs still containing embryos. Empty eggshells have also been recorded in the tissues of the host by Otani (1887), Miura (1889), and Yamagiwa (1892).

Pending confirmation of the alleged early segmentation of the egg before it is laid (Kerbert) or in the sputum (Manson), or of its possible development to the miracidium stage in the tissues of its host (Kellicott), it is more natural for us to expect, especially in view of Leuckart's observations, that the normal course of events is for the egg to be laid in unsegmented stage and to be expectorated in that condition. This is certainly what occurs in the form found in hogs. As yet no literature is accessible giving an account of how the segmentation of this species takes place.

Miracidium.—Thus far at least two observers (Manson, 1882, and Nakahama, 1883) have succeeded in raising the embryonic stage. Manson (1882A) states that when the eggs are washed free from the sputum and kept in water at a temperature of 80° to 94° F. (26.7° to 34.4° C.) an embryo develops in about six weeks to two months. This miracidium is ciliated only on the posterior two-thirds of its body, the cilia "extending as far forward as the rounding in of the shoulders." Nakahama's paper is in Japanese, and we are unable to read it, but according to Leuckart (1889, p. 436) Nakahama succeeded in showing that when the eggs which are expectorated in the sputum are subjected

to a temperature of 30° C. (86° F.) for twenty-eight days the ciliated embryo is developed. This miracidium (fig. 28, p. 565) is oval in form and is provided with a small projection on its anterior extremity. According to Manson, if expressed from the eggshells a week or two after the cilia develop, the embryos live in water only a few minutes; but at a later stage, when the miracidium escapes from the egg by its own efforts, it may live much longer. Manson kept one alive over twenty-four hours. From certain experiments detailed in his article, Manson concludes that upon expectoration from the lungs the eggs perish unless they are freed from the surrounding mucus and have access to water; if, however, water is supplied to them even in small amount, they preserve their vitality. Thus it would appear that in water, freed from the mucus and exposed to a temperature of 80° to 94° F. (26.7° to 34.4° C.), the ciliated embryo develops in from four to eight weeks; and that certain conditions, such as not being freed from mucus and probably a lower temperature, retard the development.

How long the eggs preserve their vitality in dried sputum or in dust does not appear to have been established. From a hygienic standpoint definite information on this point is important. Remaining in moist sputum for any length of time, corresponding to a part of Manson's experiments, would probably rarely occur in nature.

Beyond the miracidium stage nothing is positively demonstrated in the development of *Paragonimus Westermanii*. As Leuckart remarks, it would be contrary to all analogy to assume that this is the infecting stage for man and other animals. On the contrary, the presence of cilia indicates an aquatic life, and, so far as can be foreseen from analogy, the miracidium, after swimming around in water, will eventually attack some invertebrate (probably a mollusk) and will develop into a sporocyst; rediæ and cercariæ will probably be formed, much the same as are described for *Fasciola hepatica* (see pp. 31-33, figs. 6-12, of Bulletin 19), and either an encysted or free-swimming cercaria will in all probability be the stage in which the parasite will enter its final host (man, cat, tiger, dog, hog).

Whether it will immediately attack the lungs, as suggested by Baelz, or first some other organ and later wander to the lungs, as suggested by Leuckart (1889, p. 437), is an open question. In this connection reference may be made to the finding of an agamic distome in hogs' muscles by Mr. Bullard at Buffalo, N. Y. (see p. 559). It can not at present be considered impossible that Bullard's parasites represent a younger stage of the lung fluke, either accidentally or normally encysted in the muscular tissue.

SOURCE OF INFECTION.—The discussion of the life history and the assumption that a cercaria forms the infecting stage bring up several views expressed in Japan. Throughout the Asiatic literature on the

subject frequent references are made to the water supply, and it is clear that our Eastern colleagues look upon this as the source of infection. This view has much in its favor, and cautious persons will do well to drink only boiled or filtered water, especially when in infected fluke areas. The following references by various writers will be of interest in this connection. Manson (1882A) in referring to one of his patients (Heng) writes:

"He says he never exercised discretion about the water he drank, especially when young; used to take it from the river, well, paddy field, or ditch—which ever lay most convenient; and he says that nearly all North Formosans are similarly indiscreet."

As prophylactic measures, Kiyono, Suga, and Yamagata (1881¹) advise against eating "raw eggs, uncooked fish, mussels, etc." Dr. Inoui and Yamagiwa (1890²) state that in Okayama, where they studied a number of cases, a species of snail belonging to the genus *Limnæus* and known as "Nina," is very abundant. Although they examined large numbers of these mollusks, they did not find any cercariæ, rediæ, or embryos of the lung fluke. Similar negative results attended their dissection of small fish. The peasants eat both snails and fish, but usually cooked. The inhabitants of the villages say that chickens suffer from a cough similar to that noticed in this malady, and that they eat the sputa of persons suffering from lung fluke disease. On this account Inoui and Yamagiwa examined both chickens and eggs anatomically and microscopically, but without finding any trace of infection. As a prophylactic measure, Yamagiwa, in a later article (1892, p. 456), also advises against eating raw meat.

That chickens eat human sputa is a well-known fact, but the possibility of their becoming infected with lung flukes through sputum from lung fluke patients may safely be looked upon as excluded. It seems possible that the cough referred to may be connected with the chicken disease known as "gapes," caused by *Syngamus trachealis* in the windpipe; while it seems more than probable that hens' eggs have fallen under suspicion because of the occasional presence of a fluke, which, to the casual observer, is not entirely unlike the lung fluke; it belongs to the species *Prosthogonimus ovatus* and has nothing to do with *Paragonimus Westermanii*. As for not eating raw meat, the advice is good on general principles, but it does not at present appear that such food will come into consideration as a probable source of infection. That Bullard's agamic distome in the muscles of hogs is the infecting stage of *P. Westermanii* may be admitted as among the remote possibilities, but hardly more. Very little pork is eaten in northern Japan, and, while eaten more in southern Japan, it is not a common article of diet among the poorer classes. This fact, and also

¹See Yamagiwa, 1892, pp. 446-448.

²See Yamagiwa, 1892, pp. 449-451.

the fact that the parasite is so much more common in men than in women, rather detract still more from the probability of such a source of infection. (See also Abattoir inspection, p. 603.) Should the unexpected prove to be the case, and Bullard's encysted form actually represent the long-looked-for stage of *P. Westermanii*, ordinary curing or cooking will undoubtedly prevent all danger of infection. Of all possible sources of infection thus far suggested, the water supply and the mollusks would appear to be more natural carriers of the cercarian stage than anything else. The lion, cat, dog, hog, and man—all of the animals for which this lung fluke¹ has been reported—are in the habit of eating meat, but all of them also drink water.

Lung Fluke Disease (Pulmonary Distomatosis) in Various Animals.

As the parasite in question has been reported from different animals, and as the possibility is by no means absolutely excluded that some minute subspecific or varietal characters may be eventually recognized which may lead to the division of the present species into subspecies or varieties, it seems best to arrange the further discussion of the worm, both from a zoological and from a medical standpoint, according to the various hosts. It may, however, be stated here that our knowledge of lung fluke disease is based almost entirely upon the disease in man. In fact, no articles have been found which deal with the symptoms in the tiger, cat, dog, or hog. Since the lung parasites in question in all these animals are so nearly alike that they are now classed as congeneric, and even as specifically identical, and since they all live the same kind of a life, it may be safely assumed that the clinical picture of the disease will be the same in all the animals; further, when the same parasite occurs in such widely separated genera as *Canis*, *Felis*, *Sus*, and *Homo*, it may almost confidently be expected that the worm can develop in still other hosts. In this connection let us refer to the hygienic status of the question in America.

The provisional view, that the lung flukes found in this country by Ward in the cat, by Kellicott in the dog, and by Payne in the hog, are identical with the Asiatic form, has an important medical bearing. When only the two finds by Ward and Kellicott were on record, the hygienic problem was present but had hardly assumed a tangible form. Two isolated cases of a noncontagious exotic disease, indirectly transmissible to man, were found in two cities separated by several hundred miles. Both Ward and this Bureau clearly foresaw the possibilities which might arise, and both warned the medical fraternity of the possible spread of a disease in the United States which might be mistaken for tuberculosis unless a microscopic examination of the sputa were made.

¹*Herpestes*, the host of *Paragonimus compactus*, and *Lutra*, the host of *P. rudis*, are also carnivorous.

At present the hygienic phase of the question is more tangible. The same disease has now been repeatedly found in hogs by inspectors of this Bureau. The possibility of its occurrence in man and other animals in the United States is thus decidedly increased. The infection has not died out, but has apparently increased in the past five years. Ward's (1895, p. 89) words that "we are then forced to conclude that this parasite is established in America, and in its presence we must recognize one of the most undesirable of human parasites," are now placed upon a much stronger basis.

In addition to the possibility of infection taking place in this country we must also consider a new phase of the question. Up to the time Ward announced his discovery we might not unnaturally have expected to find this worm in Chinese and Japanese coming to this country or in American missionaries returning from Asia. Now that so many thousand American soldiers are seeing temporary service in the East, it may be prophesied with a considerable degree of confidence that some of the troops will return to America infected with this disease. Physicians who are called upon to treat these soldiers should, therefore, bear in mind the possibility of finding them suffering from pulmonary distomatosis.

(A) LUNG FLUKES IN THE TIGER (*Felis tigris*).

The only papers in which original observations concerning *Paragonimus Westermanii* in the tiger are published are by Kerbert (1878 and 1881), Leuckart (1889), and Weber (1891). The published data are mostly zoological. We know that three tigers died and that lung flukes were found in them. Of their symptoms, the condition of their brains, the general pathologic conditions of the other organs, etc., we know nothing.

Kerbert (1878, pp. 271-274) described as *Distoma Westermanii* specimens of flukes he had received from Dr. G. F. Westerman, connected with the zoological gardens at Amsterdam, Holland. The worms came from a tiger which had died in Amsterdam. Later, Kerbert (1881, pp. 529-578) received specimens, through Dr. H. Bolau, from the lungs of a tiger which died in the zoological gardens in Hamburg. With the aid of this new material he made an extensive anatomical study of the worm. He states that the parasites were "always two together, on the outer surface of the lungs, in rather thick, horn-like capsules, which immediately attract attention by their rather blue color." Regarding the external form of the worms, he says:

"In general, the body of the animal is thick, often much swollen, of oval form, and of a more or less gray color. The dorsal surface is very convex—'domed'—and on account of the greater development of the vitellaria on this portion it is of a darker color than that seen on the flat or sometimes concave ventral surface.

As results from the conditions of the musculature in the trematodes, the diameters in the three directions of space are subject to considerable variation. According to whether this or that muscle system is active, the form of the body is changed. So I observed animals which were either cylindrical or globular. Aside from these variations due to the muscle contraction, the form of the worm in most cases was oval, 7 to 9 mm. long, 4 to 6 mm. broad, and 2 to 3 mm. thick.

"The two suckers, according to the contraction of the muscles of the body, are 2 to 4 mm. from each other, of nearly the same size, 0.78 mm., and ventrally situated."¹

It may be noted that in Kerbert's fig. 7, giving the topographical anatomy, the dermal spines are absent from the oral pole for a short distance around the mouth, and at the aboral pole a field fully twice as large is free from spines. Kerbert (p. 532) states that the size of the spines varies, those on the anterior end of the body being by far the longest (0.018 mm.), with the greatest breadth (0.002 mm.) at the base. The other spines have a length of 0.01 mm. The pharynx is 0.5 mm. long by 0.3 mm. broad. The genital pore is in the median line of the body (p. 558 and fig. 5) 0.25 mm. caudad of the ventral acetabulum. The testicles have 5 to 6 lobes each; the right testicle is immediately caudad of the transverse vitelloduct, the left testicle slightly further posterior. Referring to the eggs, Kerbert (p. 576) says that they may develop in the uterus as far as the gastrula stage—a statement questioned later by Leuckart (1889, p. 436). The eggshell measures 0.08 mm. long, 0.045 mm. broad; the operculum is 0.003 mm. high, with a base 0.023 mm. broad; the eggs are oval, with flattened poles—not shown in his figures.

Leuckart (1889, pp. 404-437) reexamined Kerbert's specimens and compared them with specimens of "*D. pulmonale*" of man. He states (p. 408) that the two parasites are specifically identical, and adds that Nakahama is of the same opinion. He admits that some differences exist between his and Kerbert's description, but he does

¹"Im Allgemeinen ist der Körper des Thieres dick, oft sehr geschwollen, von einer eiförmigen Gestalt und von einer mehr oder weniger grauen Farbe. Die Rückenseite ist stark gewölbt und zeigt wegen der an dieser Fläche stärker entwickelten Dotterstöcke eine dunklere Farbe als die abgeflachte oder auch concave Bauchseite. Wie aber aus den Verhältnissen der Muskulatur bei den Trematoden hervorgeht, so sind bei unserem Thiere die Durchmesser nach den drei Dimensionen des Raumes bedeutenden Schwankungen unterworfen. Je nachdem dieses oder jenes System des stark entwickelten Muskelapparates thätig ist, wird sich auch die Gestalt des Körpers demgemäss ändern. So beobachtete ich Thiere, die entweder eine vollständig cylindrische Gestalt darboten—oder auch die Kugelform zeigten. Abgesehen von diesen Abweichungen, durch Muskelkontraktion bedingt, war die Gestalt des Wurmes in den meisten Fällen doch eine eiförmige, mit einem Längendurchmesser von 7-9 mm., einem Breitendurchmesser 4-6 mm., und einem Dickendurchmesser 2-3 mm.

"Die beiden Saugnäpfe, je nach der Kontraktion des Hautmuskelschlauches 2-4 mm. von einander entfernt sind beinahe gleich gross—mit einem Durchmesser von 0.78 mm.—und gehören der ventralen Fläche des Körpers an."

not consider these important. Leuckart gives an incorrect spelling of the original specific name, writing it *Westermanni* instead of *Westermanii*, an error which is followed by nearly every author using the name since that date.

Weber (1891, LXXXIII) records, in an Amsterdam scientific society, a third case of "*D. Westermanni*" (*D. Westermanii*) in the royal tiger of Sumatra. Thirty-three cysts contained two parasites each; one contained three worms, and one contained but one specimen.

(B) LUNG FLUKES IN THE CAT (*Felis (Catus) domestica*).

We have records of only one case where the parasite under discussion was found in a cat, namely, by Ward. This is also the first record of the parasite for any host in America. Ward refers to the case in several papers (1894A, pp. 362-364; 1894B, pp. 355-357; and 1895.)

In his first paper (1894A, pp. 362-364) he states that the parasites, twelve in number, were taken from the lungs of a cat in Ann Arbor, Mich.; they were irregular in form, distinctly flattened, not oval, and on transverse section were an elongated ellipse; in size, seven measured specimens varied between 11.2 by 4.8 mm. and 15.5 by 7.7 mm., average 13.6 by 8 mm. The oral suckers were so distorted that measurements were only approximate, varying from 1 to 1.4 mm. in diameter. Ventral acetabulum 0.75 to 1 mm. in diameter. Ward directs attention to the differences between these measurements and those given by Leuckart, but is not disinclined to attribute the difference, in part at least, to the condition of the material. The statement (p. 363) that spines were present on the cuticle is a typographical error, as is seen from the context. Ward found no spines, a condition which he apparently attributes to the poor preservation of the material.¹ The eggs vary from "96 by 98 μ to 118 by 53 μ ," with an average of "102 by 53 μ ," thus showing a slight variation from Leuckart's measurements, "80 by 56 μ ." The measurements given are also incorrect, due to typographical error. In Ward's English article (1894B, pp. 355-357) he gives them as "96 by 48 μ to 118 by 50 μ , with an average size of 102 by 53 μ ."

Nothing is known relative to the origin or life of the infested cat; it therefore remained uncertain whether the infection took place in Asia or in America, though the latter is more probable.

Ward (1894, pp. 355-357) translated this article into English, partly to bring the parasite to the attention of American veterinarians and physicians, and partly to correct some of the typographical errors which appeared in the German text. A short supplementary note to the article was written by Stiles (1894A, pp. 358-360), giving the

¹In one of Ward's specimens sent to us a few spines have been found.

synonymy and specific description of the parasite. Stiles (1894B, pp. 57, 58, figs. 1-4) also exhibited Ward's specimens before the Johns Hopkins Hospital Medical Society, and his remarks, which were practically identical with the Supplementary note (Stiles, 1894B, pp. 358-360) to Ward's paper, were printed in the Johns Hopkins Hospital Bulletin, from which they are copied by The Veterinary Journal (London). Stiles recognized *Mesogonimus* as a subgenus of *Distoma*, in which *D. Westermanii* was placed.

All other accessible references to this parasite in cats—by Blanchard, Moniez, and others—are based upon these papers by Ward and by Stiles. (See, however, footnote p. 561.)

(C) LUNG FLUKES IN THE DOG (*Canis familiaris*).

Three authors have published original observations regarding the presence of *Paragonimus Westermanii* in dogs, namely, Railliet (1890), Kellicott (1894), and Ward (1895). The parasite is recorded for the dog in Japan, and one case has been found in the United States. In neither instance does it appear that the specimens were compared with specimens from man, nor have the American specimens been compared with the Japanese.

Railliet (1890, p. 143) records specimens of *Distoma pulmonale* from the bronchi of a dog; the worms were in the Japanese veterinary exhibit at the Paris Exposition. He places the form in the genus *Mesogonimus* with the remark that the species in question should be given the name "*M. pulmonalis*, or better, *M. Ringeri*, or better still, *M. Westermanni*." No anatomical observations are made. Railliet (1893, pp. 369, 370) again refers to these specimens, but makes no additional remarks. (See also footnote p. 561.)

Kellicott (1894, pp. 122-126) records that in March, 1893, the lungs of a dog which had been prepared for dissection in Columbus, Ohio, were found to have "small brown spots thickly distributed over the entire surface of the pleura, and scattered over the lobes were many tumor-like swellings of a deep-red color, contrasting strongly with the general pink of the lung. The tumors were mostly about the roots and along the dorsal borders of both sides. On cutting open the tumors distomes were found within; some were surrounded by a capsule, whilst others were burrowing after the manner of the large distomes in the livers of sheep and cattle; these burrows were filled with pus and débris." The length of the worms was 15 to 20 mm.

Eggs of the worm "occurred in immense numbers throughout the tissue of the lungs. So numerous were they in the vicinity of the cysts that they changed the hue of the lung to their brown shade. Besides those scattered in the tissue there were great numbers collected just under the pleura in groups, varying from a few to several

hundred. These masses were not only in the pleural covering of the lung, but in the pleura of the thoracic walls; the masses in some instances in rows over the costal vessels, in others opposite the ribs."

Ward examined Kellicott's specimens, and determined them to be *Distoma Westermanii*. He refers to this fact in two articles (1895A, pp. 87-89; 1895B, pp. 236, 237, figs. 1-3). Kellicott's specimens showed the genital pore posterior of the acetabulum and not anterior, as Kellicott had supposed. Ward (1895B) gives the measurements of the oral suckers as 0.864 by 1.017 mm., and of the ventral acetabulum as 1.17 by 1.31 mm. He says the eggs of *D. Westermanii* are 0.08 to 0.1 mm. by 0.05 mm. (Leuckart), or 0.096 to 0.118 mm. by 0.048 to 0.055 mm. (Ward). He also gives a description of the worm, and warns American physicians of its possible presence in man in the United States; and finally he gives a short account (1895B) of the symptoms recorded for persons attacked by it, as described by various authors.

(D) THE LUNG FLUKE IN MAN (*Homo sapiens*) AS CAUSE OF PARASITIC HÆMOPTYSIS AND JACKSONIAN (CORTICAL) EPILEPSY.

NAME OF THE DISEASE.—The disease now under discussion is known under the following names:

ENGLISH.—*Parasitical hæmoptysis* Manson, 1880, and *The Lancet*, 1880, *Endemic hæmoptysis* Manson, 1883; *Lung fluke disease* (as vernacular term); *Pulmonary distomatosis* (in part).

GERMAN.—*Parasitäre Hæmoptoe* Baelz, 1880; *Gregarinose pulmonum* Baelz, 1880; *Wurm-Hæmoptoe* Leuckart, 1889; *Lungendistomen-Krankheit* Yamagiwa, 1892; *Distomatose pulmonum*.

FRENCH.—*Hæmoptysie parasitaire* Chédan, 1886; *Distomatose pulmonaire* Blanchard, 1895.

ITALIAN.—*Emottisi parassitica* Sonsino, 1884; *Emottisi cronica* Sonsino, 1896.

SPANISH.—*Hemoptisis parasitaria* Bonis & Cortezo, 1882.

LATIN.—*Gregarinosis pulmonis* Bonis & Cortezo, 1882.

All of these names have been well chosen, with the exception of "gregarinosis" and "gregarinose," two terms based upon the erroneous opinion that the parasite in question is a protozoan belonging to the genus *Gregarina*.

The term "parasitical hæmoptysis" is descriptive both as to symptoms and cause; yet it should be recalled that not only is hæmoptysis not a constant symptom in this malady, but that it is also found in other diseases; likewise it may be noticed that the hæmoptysis in tuberculosis is as truly "parasitic" as in this disease.

The term "endemic hæmoptysis" is, from the standpoint of the Asiatic, a fairly acceptable name, yet it might equally well be applied to other maladies.

"Lung fluke disease" and "pulmonary distomatosis" have the

advantage of immediately calling attention not only to the most common seat of the trouble (the lungs), but also to the cause, namely, flukes or distomes. Some persons may object that both "flukes" and "distomes" are very broad terms zoologically, and that other flukes besides *Paragonimus Westermanii*, notably *Fasciola hepatica*, may be found in the lungs. While this objection is not entirely without foundation, it may be replied that *Fasciola* is a genus containing primarily true liver flukes, whose normal habitat is, in fact, the liver; *Paragonimus*, on the other hand, contains flukes which are primarily inhabitants of the lungs. The occurrence of *Fasciola* in the lungs and of *Paragonimus* in the brain is somewhat exceptional.

Accordingly there appears to be no serious objection to any of the English names thus far proposed, especially when we recall that it is not necessarily the function of the name of a disease to give a full description of its nature, cause, pathology, treatment, geographical distribution, and mortality. "A name is only a name" and has no necessary meaning except as the designation of the object to which it is applied. From the standpoint of the helminthologist, therefore, any of these names may be adopted. To the zoological nomenclaturist even the name "*Gregarinosis pulmonis*" would not necessarily give rise to confusion, but among the members of the medical fraternity, by whom terminology is used without any stated rules or code, this name would be objectionable and calculated to give rise to serious error.

If one desires to be more exact in names than would be possible by using any of those above cited, all possible chance of error may be avoided by referring to the *Paragonimus* (or *Mansonian*), the *Fasciola*, and the tubercular varieties of parasitic hæmoptysis.

If, however, a general name is desired to cover not only the more usual lung infection, but also the infection in the brain and other organs, the term *Paragonimiasis* may be formed, similar to *Ascariasis*, *Teniasis*, *Fascioliasis*, *Trichiniasis*, *Filariosis*, etc. The advantages of such a term are: (1) Being Latin in form it may be used by physicians and zoologists of all nationalities; (2) it directs attention to the exact cause of the disease; (3) it tends toward a uniformity in the terminology of diseases. These advantages are weakened by the following factors: (1) There is no international agreement among physicians as to the formation of terms; (2) Manson's term "Parasitical hæmoptysis" is already used in English works, and has been literally translated into German, French, Italian, and Spanish; therefore, to one who reads these languages the term is already international.

As stated above, practically our entire medical knowledge relative to *Paragonimus Westermanii* is based upon its presence in man, the original observations in all cases being made in Asia. Manson, Baelz, Taylor, and Leuckart, are the Europeans whose writings con-

tain original material, the articles (so far as accessible or known to us) of all other medical authors, except the Japanese, being based upon the papers of these four men and upon papers written by Japanese physicians. It is especially to the latter that we owe most of our knowledge of the disease. Because of the language in which the discussions are published, however, only three papers by Japanese authors are accessible to those who do not read the Japanese language, namely, the publications in Virchow's Archives by Miura (1889) and Yamagiwa (1890 and 1892).

The presence of lung flukes in man causes various symptoms, according to the location of the parasites. The two chief clinical forms in which the malady appears are the so-called parasitic hæmoptysis and parasitic hæmoptysis in connection with Jacksonian (cortical) epilepsy.

GEOGRAPHICAL DISTRIBUTION OF THE DISEASE.—Lung fluke disease has been reported for the following places:

Japan.—Hon-Shū Island, from northeast (provinces of Awomori, Sendai, Izu, Shinano, and Gifu) to southwest (provinces of Okayama, Shimane, and Yamaguchi); also on the Kiushū Islands (provinces of Kumamoto, Nagasaki, and Kagoshima). (See Yamagiwa, 1892, p. 453.)

China.—North Formosa, especially, and Manson believes the large number of cases of hæmoptysis he formerly noticed in central and southern Formosa, are of the same nature. (See Manson, 1882.)

Korea.—Case of a Korean royal prince. (See Baelz, 1883.)

FREQUENCY.—In a number of articles the statement is found that in certain parts of Formosa 15 per cent of the inhabitants are affected. This statement is in at least one article attributed to physicians, but it appears to be due to an estimate made by a servant. Manson (1882) says in referring to two Chinese patients:

"Regarding their acquaintances, one of them said that 20 or 30 per cent, the other that 15 per cent, spat blood. Possibly these are overestimates, but at all events they show that the disease is extremely prevalent."

Baelz in a letter to Leuckart (1889, p. 439) states that he knows of one village in Japan in which nearly all the inhabitants harbor lung worms. Taylor (1883) thinks it too early to make statements regarding the frequency of the malady, for the disease is usually mistaken for tuberculosis, since it can be diagnosed only with the aid of the microscope (not much used by Japanese physicians at that date) and since only a portion of the cases come to the notice of physicians. Blanchard (1895, p. 739, 740) states that in the provinces of Okayama and Kumamoto, both mountainous, the disease is so frequent in certain villages and so dreaded that the inhabitants of neighboring villages will have no relations with them, and even the physicians do

not wish to go there because of fear of infection. (The origin of this statement has escaped us. See, however, Railliet, 1893, p. 370.)

PREDISPOSITION.—According to Yamagiwa (1892, p. 454) certain persons are more predisposed to the disease than others. From a helminthological standpoint, it may be questioned whether the fact that the disease has been found more in certain classes of patients than in others is due to an actual predisposition, or whether it is not due rather to a greater risk of infection to which some persons may be subject. Thus tapeworms appear to be more common in women than in men, but this fact is due to women's being more liable to infection (in preparing food) rather than to any constitutional predisposition. The various data gathered thus far are as follows:

Age.—While the disease may attack persons of any age, it appears to be rarely diagnosed in very young or very old persons. From present statistics, it is more common in persons in youth and early manhood. Thus of 59 cases compiled from literature, 45 were from patients between 11 and 30 years old:

From 1 to 10 years old,	4 cases, Yamagiwa, 1892.
From 11 to 30 years old,	45 cases, divided as follows:
[From 10 to 20 years old, 14 cases]	Yamagiwa, 1892.
[From 15 to 25 years old, 19 cases]	Baelz, 1880.
[From 21 to 30 years old, 12 cases]	Manson (1), 1882; Yamagiwa (2), 1890; Yamagiwa (9), 1892.
From 31 to 40 years old,	7 cases, Manson (1), 1881; (1), 1882; Yamagiwa (5), 1892.
From 41 to 50 years old,	2 cases, Yamagiwa, 1892.
Over 50 years old,	1 case, Yamagiwa, 1890.
Total,	59

Sex.—Judging from statements by Eastern authors and from accessible statistics, the disease is more frequently diagnosed in male than in female patients, and it may therefore be assumed that men are more exposed to infection than women. Thus, of 66 compiled cases of known sex, 58 were males and 8 were females, divided as follows:

Males 2, females 0	.....Manson, 1880; 1881.
Males 19, females 0	.....Baelz, 1880.
Males 2, females 0	.....Manson, 1882.
Males 1, females 0	.....Baelz, 1883 (Korean prince).
Males 1, females 0	.....Taylor, 1883, p. 47.
Males 3, females 2	.....Baelz (see Leuckart, 1889, p. 439).
Males 1, females 0	.....Miura, 1889.
Males 1, females 0	.....Yamagiwa, 1890; 1892, p. 448 (Otani's case, 1887).
Males 1, females 0	.....Yamagiwa, 1890; 1892, p. 449.
Males 26, females 6	.....Yamagiwa, 1892; p. 449.
Males 1, females 0	.....Yamagiwa, 1892; p. 451.
Males 58, females 8	.....Many other cases, sexes not definitely given.

Occupation.—Taylor (1883) says that the parasite attacks persons irrespective of occupation. He is undoubtedly correct in this intimation that occupation is no protection against infection, if the person is exposed. Yet there need be no surprise, if, as is to be expected, persons following certain occupations will be more subject to infection than persons otherwise employed. From the few statistics thus far collected, relative to occupation, it may be noted that of 51 patients, 38 were farmers, 6 officials, 1 student, 1 laborer, 1 merchant, 1 coolie, 1 house boy, 1 shoemaker, 1 prince. Yamagiwa (1892, p. 450) states that in Kumamoto students (hospital cases) are among the most frequently affected.

Personal habits.—Yamagiwa (1892, p. 450) records that 12 patients out of 38 were drinkers.

Physical condition.—Several authors state that persons of strong constitution are more subject to the disease than persons of weak constitution.

DURATION.—It is generally conceded that patients may live for years—ten to twenty, or perhaps more—after noticing the first symptoms.

PROGNOSIS.—Patients may entirely recover if sent into a healthy noninfected area. Yamagiwa has repeatedly noticed cases of this kind, where egg cysts were found in the mesentery, mediastinum, or lungs, but no adult worm was found. In general, the prognosis depends upon (a) the number and (b) position of the parasites present, (c) age of patient, and (d) complications.

(a) The greater the number of parasites in the lungs the greater is the chance of severe pulmonary hemorrhage or of emboli in the brain.

(b) If the worms are confined to the lungs the patient may live for years; severe hemorrhage or repeated profuse hemorrhages are naturally dangerous in proportion to the amount of blood lost within a given time. If the parasites or their eggs gain access to the brain the prognosis is unfavorable.

(c) According to Yamagiwa (1892, p. 455) development of patients under 10 years of age is retarded by lung worm infection, while in old patients the nourishment is considerably impaired.

(d) When complicated with pulmonary tuberculosis, prognosis is unfavorable. (See Yamagiwa, 1892.)

DIAGNOSIS.—Microscopic examination of sputa for *Paragonimus* eggs.

TREATMENT.—Manson (1882) tried several treatments by inhalations, and thought they were not entirely unsuccessful.

Proceeding on the supposition that the parasites were in the bronchial tubes, instead of in the lung tissue, he gave inhalations of various drugs atomized by Lister's steam apparatus. In this way tincture and infusion of quassia, infusion

of koussou, solutions of turpentine, and santonine in spirits of wine were introduced into the lungs. Burning sulphur was inhaled twice daily for a week in one case and for a fortnight in another. The patient appeared to be somewhat improved so far as the cough and the expectoration were concerned, but ova were still found in the sputa. Three months later one of his patients considered himself cured, as he neither coughed nor spat blood; the other patient, however, still spat blood.

Taylor (1883) has no confidence in specific treatment, but advises a general course of medication, according to indication. He says:

"*Treatment.*—No benefit has yet been derived from medicine, although the great majority of anthelmintics and antiparasitics have been tried, as well by the mouth as by inhalation. Patients have improved under medicine, but a like improvement is observed when no medicine is taken, the hygienic surroundings remaining the same. And from the nature of the case it seems reasonable to suppose that no antiparasitic could be given in sufficient quantity to destroy the parasite or drive it from its lodgment in the lungs without seriously endangering the life of the patient.¹ General treatment according to well-known principles is undoubtedly useful, viz, tonics, quinine, iron, cod-liver oil, occasionally expectorants, and at times, when the patient is reduced, stimulants, and, above all, rest and good food.

Exertion aggravates the cough and expectoration. Many patients have learned by experience to be quiet and spend most of the time in bed when at the worst. In one case which came under my observation the patient was much reduced, spitting large quantities of blood, anemic, with some edema, and no appetite. Under a simple tonic of quinine and iron, stimulants, expectorants, good food, and enforced quiet, marked improvement, with diminished cough and expectoration, was noted after a few days. The number of ova became less and less, and in a comparatively short time he was up, feeling quite comfortable. Such cases as these occurring constantly are calculated to make us very skeptical as to the influence of special remedies. But no amount of improvement announces a cure. Whatever is effectively done must be done in the way of prophylaxis."

Yamagiwa (1892) knows of no practical specific medical treatment. He thinks surgery might be tried if the exact position of the more superficial cysts could be more definitely located (X-rays?). By change to an uninfected region danger of reinfection is avoided and the parasites may disappear, becoming disintegrated or (see p. 589), in some cases, possibly by being coughed up.

PROPHYLAXIS.—Positive prophylactic measures can not be given until the cercaria stage of the parasite is found. In general, however, care regarding the drinking water—to have it filtered or boiled—appears to be the most probable preventive measure which can now be proposed. There appear to be no valid grounds at present for suspecting eggs, fish, or meat, as suggested by some of our Japanese colleagues.

The following measures would undoubtedly accomplish much in preventing the disease from spreading:

¹ Compare pulmonary tuberculosis, verminous bronchitis, and verminous pneumonia.

(a) Infected patients should use sputum boxes, such as are used by consumptives. If cuspidors are used, it would be positively dangerous to empty their contents into any drain the sewage of which does not go directly into the sea. In all probability salt water would kill the miracidium. To empty cuspidors into a drain the sewage of which is used for fertilizing would be deliberately to comply with conditions which would be, on general principles, most favorable to the spread of the disease. If the sewage drains into a river the conditions for spreading the disease would also be very favorable. A comparison of the relative merits of the dry versus the wet cuspidor can not be given until experiments in drying the eggs are conducted. On general principles the dry cuspidor would be better in this case (contrary to the conditions in tuberculosis), since as a rule trematode eggs are easily killed by drying.

(b) Cats and dogs which cough up blood should be examined for this parasite, and if *Paragonimus* eggs are found in the expectorations the animals should be killed and burned.

(c) If hogs are discovered coughing up a dirty yellow, brown, or bloody expectoration, they should immediately be sent to slaughter. In abattoir inspection infected portions should be "tanked for fertilizer," but if healthy the meat of such a hog may be safely placed on the market. (See Abattoir inspection, p. 600.)

SYMPTOMS.—The symptoms vary according to the location of the parasite.

(a) *Lung infection.*—This is the usual form. Sputa very similar to that seen in pneumonia, and of a dirty red to brown color, due to the presence of microscopic worm eggs; spitting of blood common, but not constant, often intermittent; cough common, but not constant. All symptoms increased after violent exertion. *The only constant and specific characteristic is the presence of the eggs in the sputum; as many as 12,000 eggs may be expectorated daily.*

Taylor (1883) summarizes all the symptoms known to him, either from personal observation or from literature, as follows:

"Symptoms and course.—The symptoms are often mild. The patient at first has a slight cough, and occasionally ejects discolored sputa. This may occur frequently or only once during the day; it may continue for a day only, or for a week or ten days, after which it disappears, not to be noticed again for some time. Advice is seldom sought on account of any feeling of illness due to the disease. The patient may incidentally mention the fact of his spitting blood; or having a cough he may be curious to know the cause of his discolored expectoration. The sputa, generally small in quantity, consist of small pellets of blood mingled with mucus, or they may be dark, or resemble the characteristic expectoration of pneumonia. The patient seldom knows when the affection began; all that he can say is that he happened to notice it at a certain time. As the expectoration increases, the cough, which seems to depend on it, increases also. Neither is constant, but both occur at intervals, at first of long duration. As the disease progresses the intervals become shorter and the periods of coughing and expectoration continue

longer. After a time the expectoration remains permanently bloody, and can be induced at any time by voluntary coughing. The cough is not generally distressing, but as the disease progresses it may become so. The amount of expectoration, which, as I have said, is generally small, does at times become quite large, so that as much as ten or twelve ounces may be ejected in a few hours. When these large hemorrhages occur, as they sometimes do every few days, they rapidly reduce the patient. When, however, the disease—which is often the case—makes but slow progress, the patient, after having occasional bloody sputa for six, eight, or even ten years, is apparently no worse. This form of hæmoptysis is but seldom associated with phthisis or other serious lung trouble.

“Physical examination seldom reveals anything abnormal except in the worst cases. But as the patient fails, auscultation detects diminished respiratory murmur, the breath sounds becoming bronchial in character. The temperature is normal or but slightly elevated in bad cases. As time progresses the patient, exhausted by cough and hemorrhage, becomes deeply anemic and suffers severely from dyspnea on trifling exertion. Slight edema often occurs. There is a sensation in the chest variously described as one of oppression, or of heat, or of mere irritation. Occasionally there are wandering pains in chest, most probably neuralgic. The patient feels worse before a hemorrhage and weaker after it. After a time spent in bed these symptoms abate, and he so far recovers as to be up and about, sometimes apparently almost well, excepting the cough and expectoration. Months may pass before he relapses, but relapse is certain to happen. The same series of events occurs again and again, but after a time the constitution becomes gradually undermined, convalescence becomes less complete, the periods of relief shorter, those of prostration severer and longer, edema increases, anemia becomes more pronounced, and at length, worn out by cough and repeated hemorrhages, the patient dies.”

Manson (1882) gives the following as a typical case:

“Heng, male, æt. 31; resides in Sinhang, Tamsui, where he works as a house coolie. His family, he says, is quite healthy; his mother, aged 44, and three brothers and four sisters, are alive and well. His father died at 58 of dropsy and a sister died in childhood of smallpox. He himself is liable to ague. He was born in the town of Banka and lived there till his eighteenth year; then he lived in Kelung for two or three years; afterwards he removed to Hobe, Tamsui, where his home has been for the last ten years. He has traveled about the north part of the island a good deal; been in Tekchham two or three years ago; and eight months ago accompanied some Japanese to Khilai, on the east coast, where he resided for upwards of a month. His blood spitting dates from eleven years ago; he was then working on the tea hills with his father near Banka. At first he noticed when he breathed hard in carrying heavy burdens that he coughed a little and brought up mucus mixed with blood, but, as a rule, unless exerting himself violently, he only brings up a few drops mixed with the mucus. Sometimes he does not spit for a few days, perhaps a month on end, and then the hæmoptysis recurs, to last for one or two months. He has a slight cough, but on auscultation nothing much amiss can be detected. His thorax is finely developed.” [See also quotation, p. 572.]

Lung infection may be complicated by infection of the (*b*) brain, (*c*) liver, or (*d*) other organs.

(*b*) *Brain infection*.—If the worms or their eggs gain access to the brain, epileptiform attacks (Jacksonian, or cortical, epilepsy) may result. Cases have been reported by Otani (1887), Inoui and Yamagiwa (1889), and Yamagiwa (1890). The best accessible account of

such cases is in Yamagiwa's (1890) paper. As causes of Jacksonian (cortical) epilepsy he gives:

- (1) Tumors of various nature—Charcot (1833), Obernier, and others.
- (2) Cerebral syphilis—Todd (1856), Charcot, and others.
- (3) Softening, cyst-building, sclerotic centers—Knecht, Futterer, Hammond, and others.
- (4) Encephalitis, periencephalitis with adhesions, and meningitis—Huguenin, Bourneville, Mendel, Sakaki (1889), and others.
- (5) Parasites, such as *Cysticercus cellulosæ*, reported by Griesinger (1872) and others; or *Echinococcus*, reported by Westphal (1873) and others; and *Distomum pulmonum* (= *Paragonimus Westermanii*), reported in Japanese by Otani (1887) and Yamagiwa (1890). Since these cases and no similar cases appear to have ever been published in English, it may be well to abstract them more or less in detail:

Otani's case was a 26-year-old shoemaker, weakly since birth, but without any hereditary taint. In July, 1885, suffered from digestive troubles, with slight cough. Late in the spring—1886—he suddenly suffered from chills and fever, not malaria, had sharp pains in right thorax and severe attack of coughing. About a week later he noticed that his sputa was colored a dark brownish red. Ten days later felt much better, but bloody sputa continued; occasionally night sweats, rise of temperature in the evening, and showed, in general, symptoms usually met with in consumptives. May, 1887, epileptic attacks began, one occurring nearly every month, but the intervals gradually increased in length.

September 9, 1887, admitted to the "inner station of the Kumamoto hospital." At that date, temperature 38.6° C. (101.5° F.); pulse rapid, weak, could hardly be counted; pupils contracted; "stands up and jumps as if he wanted to leave the bed." According to report, frequent epileptiform attacks had occurred since the evening previous. September 10, temperature, 37° C. (98.6° F.); pulse, 73; no attack, but patient very exhausted. September 12, again unconscious; temperature, 39° C. (102.2° F.); pulse, 100; more than ten attacks of cramps. September 15, semiconscious; temperature, 39° C. (102.2° F.); pulse, 120; keratitis of left eye; dirty brown sputum, containing distome eggs. September 17, apathetic condition continues; temperature, 37° C. (98.6° F.); pulse, 80; a tightly adherent, hard tumor, painful to touch, size of goose egg, noticed in the fossa supraclavicularis. September 18, semiconsciousness continues; temperature, 38.8° C. (101.8° F.); pulse, 110. September 19, regained nearly normal consciousness. September 25, unconscious; temperature, 38.8° C. (101.8° F.); pulse, 106. September 26, death, with appearances of collapse. [For autopsy notes, see pp. 589, 590.]

In a later paper Otani (1888) states: "A cystic tumor may also be produced in the brain by distomes, and this tumor may produce epileptiform attacks."

Yamagiwa then gives a detailed account of another case of Jacksonian epilepsy produced by the same species of parasite:

T. B., 20 years old, male, baker, from Awomori, a northeastern province of Japan; no hereditary taint; parents and brothers and sisters healthy; patient strong; moderate drinker and smoker; no history of syphilis or head injury. First attack March, 1887, after a walk, during which he was caught in the rain on his return and was wet through. Upon reaching home he felt as if he were being strangled. Shortly afterwards his head felt heavy; dizziness and unconsciousness followed; recovered consciousness for a short time; convulsions of left arm, then of left pectoral muscles; became conscious again after two hours, then again unconscious, with convulsions of left leg; conscious again after two hours, but severe headache and dizziness.

After that he had two to three daily attacks of convulsions with unconsciousness. The order of the convulsions was always the same: First the left arm, then entire left side. During the intervals he was normal, both mentally and physically. Toward the end of 1887 the attacks ceased, but he complained of seeing a colored ring in his left eye, and his gait was disturbed by feelings of dizziness. Early in February, 1888, convulsions of left side reappeared; again disappeared, but paresthesia of left leg remained. Diagnosis of beri-beri was made by some physician and applications to numb place were ordered; edema of the part appeared, resolving itself into suppuration. Convulsions of left side reappeared.

March, 1888, admitted to Tokyo hospital, Professor Baelz's clinic. Slight paresis of left nervus facialis; tip of tongue, on being stretched forward, turned slightly towards the left; also movement of left half of tongue somewhat slower; speech thus somewhat less distinct than usual; severe headache, dextral; sensitiveness increased; mental faculties weakened; frequent insomnia; flexor contractions, with paresis of the left hand and elbow joint; partial paresthesia, hyperesthesia of left arm, which is cold, subjectively and objectively; left leg almost normal; attacks gradually decreased in frequency. Discharged from hospital December 8, 1888, after he had passed thirty days without attacks.

Attacks returned toward end of December, 1888; readmitted to hospital February 25, 1889. Pulse 72, respiration 20. Nothing abnormal mentally. As compared with the right side: Left side of face thinner; left naso-labial depression shallower; tip of tongue moves toward left when extruded; left corner of mouth lower; left eye can not be so tightly closed; unable to wrinkle left side of forehead; sense of touch and sensitiveness of left side of head decreased; speech indistinct; headache not so severe as formerly; now and then extreme dizziness; memory poor; no nausea; eyesight decreased on left side more so than right; ophthalmoscopic examination negative; sense of hearing and of smell dulled, of taste normal; right side of thorax narrower than left; excursion of respiratory movement of left greater than of right. Physical examination shows only slight respiratory murmur at left fossa infraclavicularis and at the slightly depressed right half of the interscapular space, with slight increased resistance at the corresponding places. Left arm paretic; can not be raised as high as right. Both legs emaciated; left foot can not be raised as high as right in walking; sensibility retained. Sight poor; colored ring complained of in left eye.

On March 22, occasional convulsions of left leg, lasting two to three minutes; after noon more severe attack; cramps at first clonic; at last became tonic; opisthotonos; frothing at mouth; finally general cramps. March 27, twenty-four attacks. March 28, eighty-seven attacks of three to four minutes' duration each. March 29, one hundred and four attacks. March 30, eighty-seven attacks. March 31, unconscious the entire day; cramps follow each other at short intervals; the more intense the cramps the greater is the dyspnea, and the more rapid is the pulse. April 1, same as previous day; cramps increase in frequency and intensity. April 2, gradual exhaustion; death. [For autopsy notes, see p. 590.]

The symptoms of the patient in question may be summarized as left lateral convulsions, which afterwards became general, but which were still more severe on the left side; defective vision of left eye; right eye slightly sympathetic; and relatively slight lamina of the extremities. Symptoms which may be explained by repeated isolated stimuli ("Eine Summe isolirter Reize") of, for the most part, still well-preserved motor centers.

(c) *Liver infection*.—Two cases of cirrhosis of the liver with ascites have been observed; *Paragonimus* eggs were found in the interstitial tissue. (Yamagiwa, 1892, p. 453.)

(d) *Infection of other organs.*—Cysts of *Paragonimus* eggs in the mesentery, great omentum, etc., have not produced any notable symptoms.

PATHOLOGY.—(a) *Lung infection.*—On the surface of the lungs or directly under the pleura cysts are formed which are usually smooth. The cyst wall is composed of newly formed tissue with round-cell infiltration and of loops of the blood vessels in the surrounding tissue. These cysts may contain one, two, or several specimens of *Paragonimus* with their eggs, or only the eggs may be found; Charcot's crystals are always present, and occasionally cholestearin crystals.

Taylor (1883) summarizes the post-mortem appearance as follows:

"Morbid anatomy.—Four postmortems have been reported—two at Okayama in 1881, one in Tokyo in 1892, and again one in Okayama in 1893. Others may have been made and reported, but they have not come under my observation.

"Externally the lung presents little or no change in appearance. The parasites are found in the smaller bronchi, and also burrowing in the lung tissue. Whether the parasites in the bronchi are found adhering to the mucous surface by their suckers is not stated. When the lung is cut across, their burrows are laid open, and though varying somewhat these are generally about the size of a filbert. They frequently communicate with one another, and always with the smaller bronchi, sometimes by several openings. Some communicate directly with a bronchus, the lumen of this latter and the burrow forming one cavity, while the bronchus presents the appearance of having a sac-like dilatation on one side. Such cavities are probably formed by the exit from a burrow to the bronchus becoming enlarged, and, finally, the partition between adjacent burrows breaking down and forming one cavity. Each cavity is surrounded by a ring of irregular induration, extending much farther into the parenchyma of the lung in some directions than in others. The adjacent bronchi are congested and more or less inflamed. So also the circumjacent lung tissue is congested. The cavities contain broken-down lung tissue, hæmatoëdin, ova, and débris, or dead specimens of the parasite. In one case twenty distomata were found. The contents of these cavities mixed with the mucous secretion of the bronchi form the characteristic sputa. It is evident that the irritation of the parasite may at times so increase the bronchial secretion as to give rise to a large amount of expectoration, while exercise, especially when the patient is at his worst, aggravates the condition. Though the mortality from the disease is not high, there is no difficulty in realizing the condition of "physiological misery" that must necessarily accompany lungs in the condition described.

"As all special treatment must be prophylactic, the most important question in connection with the disease is that of the mode of ingress of the parasite. It seems established that food is the medium. The Japanese consume large quantities of fresh-water snails and clams. Since the larvæ of various species of distoma are harbored by mollusks, it is probable that the parasite under consideration is in its larval state to be found in some of the mollusca consumed by the Japanese. The larvæ of other trematoda are found occupying one particular species as their host, and almost exclusively confined to that species. Such a species may be restricted to well-defined geographical limits, and thus the restriction of any parasitic disease, such as endemic hæmoptysis, to certain regions would be satisfactorily explained by the corresponding restriction to the same regions of the conditions essential to the development of the parasite. What the intermediate host is remains to be determined, and when this is accomplished prophylaxis will take a definite and certain direction.

"How the expectoration is produced has been pointed out, but the cause of the hemorrhage, which is always arterial, is not quite so clear. It is probable, how-

ever, that the parasite attaches itself to the mucous surface of the bronchi by its suckers, and when it releases its hold a drop of blood oozes out and appears as a pellet of blood in the expectoration [?], the larger hemorrhages being caused by the rupture of some of the capillaries or smaller arteries. Professor Baelz explains the bleeding by the passage of the larvæ from the circulation to the bronchi.

"Hemorrhage, however, appears to be rather accidental than essential. In some cases it does not occur, and in these the expectoration is smoky or rusty, even when large in quantity. When small pellets of blood appear in the sputa from the first, they may and often do increase, small bleedings of half a dram or a few drams occurring frequently during a long period. But it is only in exceptional cases that the hemorrhages become frequent and large. Ova are not found in the pellets of blood or in the blood ejected during the course of a larger hemorrhage, but in the discolored expectoration, either with or without the bloody pellets.

"A marked peculiarity of the disease is the irregular periodicity seen in so many cases. The occasional appearance of pellets of blood has substantially been accounted for, and the increased expectoration may be caused by accumulated contents of the cavities being poured out into the bronchi. The coughing thus produced keeps up expectoration until the cavities are comparatively empty, when the patient begins to convalesce. The fact that keeping quiet adds so much to the comfort of the patient at these times gives countenance to this hypothesis. But what becomes of the parasites themselves? Are they partially cast off in the abundant expectoration? One of my patients informed me that he had coughed up a worm. It was shown him under a low power by the doctors in a native hospital, and from his description it probably was a distoma. I can not, however, be certain, as I did not myself see the specimen. It is probable that some of the parasites may be got rid of in this way; but how long does each individual distoma live in the lungs, and is an acute attack an indication that a reenforcement of the parasites has secured entrance? These are questions which I can not answer. Many cases are known to have been troubled with bloody expectoration for as many as ten years, and in one the condition had lasted for twenty. It is not at all likely that the individual life of a parasite will cover these extended periods, nor is it necessary that it should. Living under the same conditions renders the patient liable to again and again receive into his person this insidious intruder. Nor can it yet be said whether a change of locality to a place where the disease is not known is attended with permanent advantage. Persons thus afflicted seem to have derived at least temporary benefit after a change of locality. Whether those affected with endemic hæmoptysis are more liable to other pulmonary diseases is not yet determined. The probabilities are that a lung thus affected would be more vulnerable than a normal lung.

"* * * To what extent the disease occurs in Korea is not yet known. It may yet be found in some parts of China. Two of the patients seen at the mission dispensary in Hiogo were Chinese residing in Kobé, but whether they had contracted the disease in Kobé or in China could not be satisfactorily ascertained, but most probably while in Kobé."

(b) *Brain infection*.—Cysts with the parasite and eggs or the eggs alone, causing emboli, may be found in the brain. Since no cases of this nature appear ever to have been published in English, it may be well to quote here three cases somewhat in detail, which we owe to Japanese authors:

The first case¹ was reported by Otani in 1897 and was quoted in extenso by Yamagiwa in 1899. At the autopsy the cerebral meninges hyperemic, right hem-

¹ For clinical history of this case see p. 586.

isphere, especially anterior and posterior lobes, somewhat larger than left; entire surface of brain, especially of left hemisphere, showed venous stasis. Anterior lobe of right hemisphere with bluish swelling, large as a hen's egg, extending from anterior edge of I frontal convolution to anterior surface of II frontal convolution. The gyri above it are flattened and the corresponding sulci have disappeared. On posterior lobe a brownish swollen portion, at which place the cerebral membranes are thickened, clouded and adherent to the brain. Both swellings hard at their periphery, in the center fluctuating. When sectioned sagittally the tumor in the anterior lobe is seen to be composed of several cysts, from the size of a pigeon egg to that of a grain of rice, most of them communicating with one another, and all containing a yellowish to dark-brownish liquid. The semitransparent gelatinous wall of each cyst is composed of proliferating connective tissue, its inner surface brownish and provided with small openings leading to the other cysts.

The tumor of the posterior lobe shows on section two cysts as large as pigeon eggs and several smaller ones. These also communicate with each other; liquid contents dark brown and viscous; contains also a flat, elongate-oval, brownish worm, ca. 8 mm. long by 5 mm. broad. A similar worm was found in the neighboring apparently healthy tissue. No cysts in left hemisphere.

The cyst fluid contains numerous brownish ellipsoid worm eggs, 83 μ long by 51 μ broad, and Charcot's and hæmatoidin crystals. The eggs are identical with those found in the sputum of patients with lung worms. The shell is thick and often ruptured.

Otani also found lung distomes, their eggs, and the resulting pathological conditions in the lungs, and in the subperitoneal tissue and in the liver. Eggs were further found in the contents of the intestine.

A second case was reported by Miura (1889, May, pp. 310-317, taf. VII, figs. 1-3), who "apparently not knowing of Otani's publication" gave an account of some fibrous tubercles in man, caused by the eggs of parasites. Later Blanchard (1895, p. 35) interpreted these eggs as belonging to *Paragonimus Westermanii*. The patient died from acute beri-beri. Among other conditions a very large number of hard, grayish white miliary and submiliary nodules were found on the large omentum, the mesenterium, and on the parietal portion of the peritoneum.

These nodules were as hard as sand. On the base of the large omentum, nearer the larger curvature of the stomach, are met here and there contracted stellate cicatrices, in the center of which were found hard nodules the size of a bean to that of an almond; they are soft in their center; their doughy ("breiiger") content is gray-white, not bad smelling. The same formations are also present on the convex surface of the liver, on the under surface of the diaphragm, on the mesenterium, and on the anterior surface of the cecum, either single or in groups; on the cecum they were long pedunculate and when covered with water they vacillated like villi. "The pathological lesions on the dorsal thickened wall of 'Douglas's pouch' [?] were the most striking; here they were rarely separate, most of them being in groups or in regular rows, along the fine, thickly anastomosing, vascular or nonvascular chords ('Stränge'), so that they represented a moniliform net. Upon touch, these places felt as hard and rough as if one had before him a surface covered with mortar.

"It should be especially noted that these structures, here and around the cecum, were not only on the peritoneal surface, but also in the loose connective tissue. * * *

There was adhesion between the convex surface of the liver and the concave surface of the diaphragm. Upon their separation, numerous nodules, such as

¹The patient was a male; "Douglas's pouch" in English is used only for the female.—C. W. S.

described above, were found in the thickened capsule and also in the peritoneal covering of the diaphragm.

The swellings corresponded to Virchow's "fibrous tubercles," showing the same three zones which Langhans described for such structures, namely:

(1) A *central zone*, in which there was usually one, rarely two or several multinuclear giant cells and worm eggs; it is composed of a finely granular, muddy, structureless mass, or of a delicate network of a few fine stellate cells, or only of giant cells and worm eggs. Most of the egg shells were empty; they were usually oval, somewhat brown, and had a delicate operculum.

(2) The *second zone* is composed of closely crowded, round, oval, and caudate connective tissue cells. The thickness of this zone is in inverse proportion to the thickness of the third zone, and in older swellings may be entirely absent.

(3) The *third zone* is characterized by its peculiar structure, in which an outer and an inner layer may occasionally be recognized. The outer layer is composed of concentric, lamellate connective tissue with very few elongate spindle cells. In the inner zone, the stellate connective tissue cells form a fine net with the anastomoses of their delicate projections, the lumina of the meshes of which are filled with a glassy, semitransparent mass.

(4) A *fourth zone*, of loose, very vascular, connective tissue, with round cell infiltration.

The separate nodules may be very close together, surrounded by a common lamellate connective tissue layer; their centers may even be confluent, in some cases forming a curved or straight chain-like structure. Cholesterol and Charcot's crystals may be present in the tubercles. Miura thinks the eggs may possibly be those of the common liver fluke, *Fasciola hepatica*, which is rather common in Japan, but Blanchard's supposition that they belong to the lung fluke seems more probable.

The *third case*¹ was first reported by Inoui and Yamagiwa in Japanese in 1889, and later (1890) by Yamagiwa in German.

The chief lesions found on post-mortem examination were located in the brain and in the lungs.

BRAIN—Gross appearance.—The surface of the hemispheres did not show any material change. Several adhesions between pia mater and the right hemisphere, notably in the occipito-lateral region; here the gray substance was somewhat harder than usual. Upon sagittal sections of this portion there were seen dark-gray points, surrounded with a white border and thus sharply differentiated from the remaining tissue; line of demarcation between gray and white matter indistinct. These structures were found chiefly in the occipital and parietal lobes, and in the median portion of the central convolution, and were confined almost entirely to the cortical layer.

Microscopic appearance.—The enlarged and thickened blood vessels of the sulci are considerably ramified; the branches which extend into the gray substance are in part open, in part obliterated; if an obliterated branch is followed into the deeper portion of the gray substance there is found an irregularly shaped focus, infiltrated peripherally with numerous round cells, and containing numerous brown bodies, the latter representing trematode eggs; in many cases the lumina of the smaller blood vessels are filled with the same eggs. The surrounding proliferating and highly vascular connective tissue is infiltrated with round cells; also giant cells, occasionally containing eggs; further, also, in surrounding tissue are found numerous multinuclear Deiter's cells.²

¹ For clinical history of this case, see p. 586, 587.

² Braunched cells, somewhat resembling connective tissue corpuscles, found in the central nervous system; often increased in number in chronic inflammations of this tissue.—C. W. S.

Yamagiwa then concluded that the primary location of the parasite, which produced the eggs causing these egg emboli in the brain, was in the lungs.

LUNGS—Gross lesions.—On the upper left lobe were found here and there nodules of different size, with soft centers. The connective tissue capsule, which was highly pigmented and vascular, made them feel hard to the touch.

Microscopic appearance.—The adult parasites were not found either in the lungs or in the brain, but the lung tubercles contained similar eggs and also giant cells.

It is interesting to note that the measurements of the eggs in the brain (40.3 by 24.5 μ to 64 by 40.6 μ) were on an average (52.1 by 32.5 μ) somewhat smaller than the actual (49 by 29.7 μ to 60.1 by 36 μ) or the average (55.9 by 33.4 μ) measurements of the eggs in the lungs. These variations Yamagiwa attributed to secondary conditions (direction of the section, compression, preservation, calcification, etc.)

Thus, to summarize, Yamagiwa shows: Disseminated circumscribed foci of trematode eggs, usually also with giant cells, in the cortical substance of the brain; localized in the occipital, parietal, and central lobes; surrounded by connective tissue neoformation and round cell infiltration; thickening of the wall of the blood vessels, especially of the adventitia, and obliteration of some of the branches; associated with lesions in the lungs containing eggs of the same species and giant cells.

(c) *Liver infection.*—Cirrhosis of the liver resulting from emboli of eggs in the portal area (or perhaps coexistence of *Paragonimus* egg emboli with cirrhosis of the liver due to other causes).—(Yamagiwa, 1892, p. 454.)

(d) *Infection of other organs.*—Cysts containing eggs of *Paragonimus* and fibrous nodules have been found in the mediastinum, diaphragm, mesenterium, and walls of the intestines; and Otani is said to have found abscesses in the cervical and inguinal regions caused by trematodes. Eggs have also been found in the contents of the intestine. No lesions have been noticed in the spleen or the kidneys.

HISTORICAL REVIEW OF THE MEDICAL LITERATURE.

Since most of the medical articles on this disease are inaccessible to the majority of physicians in this country a general review of the literature will be given here.

Manson (1880, August, pp. 138, 139) in a letter (dated May 4) to Cobbold described a case of hæmoptysis in a Chinese in which fluke eggs were found in the sputa; at the same time he mentioned the finding of a fluke in a Portuguese by Dr. Ringer. He forwarded Ringer's parasite to Cobbold, who (1880, pp. 139, 140) named it *Distoma Ringeri*. The description is very poor, and were it not for its habitat and the history of the specimen it would be impossible to identify the worm. The figures are the same which Manson gives in his publication in China (1881, pp. 10-12), while his letter contains an abridged statement of the facts published in the same paper. This letter by Manson to Cobbold has been very generally overlooked, and its publication in August establishes Manson's priority over Baelz, contrary

to the generally accepted view, and contrary even to Manson's own interpretation of the case.

Cobbold states that the parasite is similar to one which he described as *Distoma compactum* (= *Paragonimus compactus*) from the lungs of an Indian ichneumon (*Viverra mungos* = *Herpestes mungo*), but that he considered the two species distinct. (See p. 605).

Baelz (1880, September, pp. 721, 722) states that in Japan an undescribed disease occurs in which perfectly healthy people cough up bloody sputum either continually or at intervals for years. These bloody sputa are in no way related to phthisis or to any lung affection apparent upon physical examination; even after ten years' duration the patients show no subjective or objective symptoms except the cough and occasional expectoration. The malady appears to be more common in the south of Japan than in the north, but is found everywhere. Baelz has seen 19 cases, all men between 15 and 25 years of age. The sputa have a characteristic dirty red color and are very viscous. The red color is due chiefly to blood, hence varies in color with the amount of blood present. There are also oval "parasites" (= eggs) in the sputum, measuring 0.13 mm. long by 0.07 broad, and provided with an operculum on the blunt end. These larger bodies are looked upon as psorospermian cysts, which Baelz names *Gregarina pulmonum* or, because of their color, *Gregarina fusca*. Smaller bodies (0.01 to 0.04 mm.) seen in the sputum are looked upon as young psorosperms. A review of Baelz's paper may be found in the Lancet, 1880, II, pp. 548, 549.

About a year later Manson (1881A, pp. 10-12, figs. 1-19) gives a fuller account of the facts stated in his letter to Cobbold. He had in the hospital from November 6 to December 18, 1878, a Portuguese suffering with symptoms of thoracic tumor, presumed to be an aneurism. Patient improved with rest and treatment and returned to Tamsui. He died suddenly in June, 1879, from rupture of an aneurism of the ascending aorta into the pericardium. Dr. Ringer, who performed the autopsy, stated in a letter to Dr. Manson, in addition to giving the immediate cause of death:

"After making a section I found the parasite lying on the lung tissue; it might have escaped from a bronchus. While alive a number of young (microscopic) escaped from an opening in the body [of the worm]. There were some small deposits of tubercle, no cavities, and, if I remember aright, slight congestion of the lungs."

Later, Dr. Manson was consulted by a Chinaman, 35 years old, relative to an eczematous eruption which he had on his face and legs. During the conversation Manson noticed that the man's "voice was rough and loud, and that he frequently hawked up and expectorated small quantities of reddish sputum. * * * To the naked eye the sputum appeared to be made up of small pellets of rusty pneumonic-like spit, specks of bright red blood, and ordinary bronchial mucus,

and contained, besides ordinary blood and mucous corpuscles, large numbers of bodies evidently the ova of some parasite." In conversation it developed that this man had gone to Tecktham, a town in North Formosa, when he was 21 years old; a year later "he first spat blood. Every day for nineteen days he brought up from an ounce to half an ounce of blood; he emaciated slightly, but had very little cough. Hæmoptysis returned about six months later, smaller in quantity, but, as in the former attack, the blood at first was pure, unmixed with mucus, and of a bright red color; this second attack lasted for a few days only. Since then he says he has spat blood for two or three days at a time, in small quantities, every second or third month. He has never had much cough, and says the blood is always mixed with mucus after the first mouthful. Once during two years he had no blood spitting. Though rather thin he enjoys good health." Manson could discover no signs of lung disease on auscultation.

Manson further states that in Formosa he had seen "many cases of chronic and oft-recurring blood spitting without apparent heart or lung lesion, and it is just possible that the hæmoptysis in many of these cases was caused by *Distoma Ringeri*."

Manson secured the specimen collected by Dr. Ringer, and after comparing the eggs with the eggs from the sputa of the Chinaman and determining the worm to be a distome, he sent it to Cobbold, who pronounced it to be new and named it *Distoma Ringeri*. Manson, in a footnote, thinks it possible that the "gregarina" described by Baelz may be an embryonal form of *D. Ringeri*.

Practically this entire article, without illustrations, was reprinted in the Medical Times and Gazette (Manson, 1881A, pp. 8, 9), and in Manson's *The Filaria sanguinis hominis* (1883A, pages 134-138). The latter is abstracted by Chédan in the Arch. Méd. Nav., XLV, pages 241-244.

In reverting to the subject, Manson (1882A, pp. 55-62, figs. 1-25) mentions Baelz's paper again and clearly shows that he considers the cases reported both by Baelz in Japan and by himself in China to be identical in nature. In fact, he examined some of Baelz's material and determined the "gregarina" to be identical with the eggs of *D. Ringeri*. He modestly gives Baelz the credit of priority in the discovery, but in this he errs. The only priority which science can recognize is priority of publication, so that the facts are accessible to the scientific public. Manson's first mention of the disease was published in August, 1880, while Baelz's paper appeared on September 25, 1880.

Manson examined the sputa of about 150 individuals in his district, but failed to find any eggs, from which he concludes that the disease must be rare in Amoy and vicinity. In North Formosa, however, only about 200 miles distant by sea, conditions relative to the disease are different. He received specimens of ova-laden sputa from John

Graham, of Tamsui, and from Dr. Johansen. Mr. Graham's servants, from whom some of the sputa came, afterwards informed Dr. Manson that hæmoptysis, such as they themselves suffered from, was extremely common. "Regarding their acquaintances, one of them said that 20 or 30 per cent—the other that 15 per cent—spat blood. Possibly these are overstatements, but at all events they show that the disease is extremely prevalent." With regard to Central and South Formosa, Manson states that he had been surprised to note the large number of cases of hæmoptysis, and that he now has little doubt that they were due to *D. Ringeri*. He does not know of its occurrence on the mainland of China, but since "both Japan and Formosa resemble each other in being volcanic and are both members of that long string of volcanic islands that, stretching along the eastern coast of Asia, includes, besides these, the Loochoos, the Bashees, the Philippines, and a host of smaller islands," Manson believes that the same parasite will be found in all of these places. Regarding diagnosis he says:

"Parasitical hæmoptysis can readily be diagnosed. There is a history of irregular intermitting hæmoptysis associated with a slight cough, and, in the intervals of more active bleeding, the expectoration once or several times a day of small pellets of viscid brownish mucus. Violent exercise is apt to produce profuse hemorrhage, and irritation of the lungs in any way so as to induce coughing causes the discharge either of quantities of blood or of the characteristic sputum. At the same time there are no objective symptoms of lung disease, and the patient probably enjoys good general health."

Manson gives notes on two cases which he looks upon as typical examples of the disease and which are here reproduced:

Heng (see above, p. 585).

"Heō, male, æt. 22; born and resident in Hobe, Tamsui; a house boy. Father and mother are both dead, both of them of some dropsical affection. Until he was 18 years of age enjoyed excellent health; then, without any obvious cause, he began to spit blood, especially after making any great exertion. During one year, many times each month, he continued to spit blood, about an ounce at a time. He then got lighter work and the bleeding ceased and has not recurred; but he has a cough still and almost every day expectorates pellets of tenacious, muddy, yellowish brown mucus. Sometimes for several days, if the weather is fine and his work is light, there is no cough or spit; but when the weather changes or he has to exert himself the cough and spit return. He complains of some pain about the left nipple, but the lungs appear healthy. His sputum is as described, and abundance of ova can be found in it."

The eggs are much like the fowl's egg in shape, and measure on an average one three-hundredths by one five-hundredths inch (0.085 by 0.051 mm.), but vary somewhat in size and shape. Some are more globular, others more elongate; their color is a dirty reddish brown, which imparts the characteristic brown tinge to the sputum when blood is entirely absent.

A very full abstract of this article appeared in the Medical Times and Gazette of July 8, 1882 (Manson, 1882B), and the original article

was reprinted by Manson in his work *The Filaria sanguinis hominis*, 1883A, pages 138-156, which was in turn abstracted by Chédan in the Arch. Méd. Nav., 1886, pages 241-244.

Baelz (1883, pp. 234-238) had come to the conclusion that the psorospermia he had described in 1878 were in reality distome eggs, a view confirmed by Leuckart, to whom he had sent some of his material. He now proposes to rename the parasite *Distoma pulmonale*. From twelve specimens he examined, he stated that they were 8 to 10 mm. by 5 to 6 mm. in diameter; plump, circular on transverse section. Color in life similar to that of an earthworm; dead specimens are gray. Acetabula about equal. Twenty specimens were taken from a man in Okayama, who had died of parasitic hæmoptysis. "The location of the worms was not, as one would naturally expect, in the wall or the lumen of the bronchi, but the animals live singly in cavern-like cavities, which are located on the periphery, something like hemorrhagic infarctions. These cavities contain a frothy, reddish mass consisting of mucus, red and white blood corpuscles, degenerated lung tissue, and numerous eggs. The wall is more or less hard, connective tissue-like, of different thickness. The cavities are connected with the bronchi only through fine sieve-like openings; through these openings the eggs reach the sputum." Baelz thinks the embryo or the cercaria reaches the branches of the pulmonary artery where it becomes fastened, and gradually by its growth and vital activity forms the caverns, sometimes causing dangerous hemorrhages and partially destroying the lung tissue.

Only exceptionally is the sputum of infected persons free from blood, and it contains thousands of eggs, which measure 0.08 to 0.1 mm. long by 0.05 mm. broad. Baelz knows of more than 100 cases in "all parts of the land," and states that while it is common in Japan, it is particularly frequently met with in the mountainous provinces of Okayama and Kumamoto. Besides Manson's cases in Formosa, the disease has recently been found on the Asiatic continent.

A Korean prince of the royal family, like many other patients with this same disease, was sent to Baelz as a consumptive. He had been spitting blood for eight years, and twice had extensive hæmoptysis.

Baelz states that Charcot's crystals are common in the sputa of these patients. Thus he claims that "asthma is not caused by the crystals, since the patients never show any signs of asthma." He also looks upon the presence of these worms in the lungs as demonstrating better than any prior observations or experiments "that the lung tissue and perhaps the smallest bronchi are not sensitive, and that their irritation does not cause any cough."

This article is abstracted by Remy (1883, pp. 525, 526), where Remy's article is in turn abstracted by the Weekly Medical Review, 1884, pp. 243, 244.

In an article in which he compares this disease with endemic hæmoptysis

turia Manson (1883B, pp. 532, 533) proposes to call the former "endemic hæmoptysis." He gives the substance of his articles published in 1881A, pp. 10-12, and 1882A, pp. 56-62. Referring to symptoms, he says:

"The constant or repeated small bleedings these parasites induce can not fail in certain cases to produce in time a state of intense anemia, rendering the subjects of it very liable to attacks of dangerous forms of other disease. But the *Distoma Ringeri*, in consequence of the position it occupies, the lungs, and the liability of these organs to great strains and congestion on exertion and coughing undoubtedly exposes its host to the additional danger of sudden and profuse hemorrhage and the consequences, whatever these may be, of infarction of the lung tissue by effused or suddenly inspired blood. I am not in a position to assign to this parasite its exact share among the causes of grave diseases, but I have no doubt that in time it will be found to operate prejudicially on the population of the countries in which it is endemic in the directions I have indicated."

Sonsino's (1884, pp. 17-21) discussion is based upon Manson's papers of 1881 and 1882. Taylor (1884, pp. 44-48, 51, 52, fig. 1) gives a general review of the distomes of man reported for China and Japan, and in this connection discusses "*Distoma pulmonale vel Ringeri*." The discussion is based not only upon original observations, but apparently also upon articles in the Tokyo Medical Journal, written in Japanese.

After stating that the parasite attacks almost all classes, irrespective of age (except the very young and the very old), sex, occupation, or physical condition, and that it is too early to give an estimate as to the ratio of victims in any district, also that many of those seriously affected are considered as having consumption, he gives an interesting account (pp. 45-48) of symptoms, treatment, and pathology. His remarks have been liberally quoted above (see pp. 583, 584, 588.)

Taylor's figure is copied from the Tokyo Medical Journal and is somewhat primitive from an anatomical standpoint. In his description of the parasite it may be noted that some of the characters are apparently based upon an error of interpretation; hence, although he gives some characters which are decidedly different from those mentioned by Leuckart, there is no ground for assuming that the forms in question are not specifically identical.

Blanchard (1888, pp. 627-630) bases his account upon the writings of Baelz (1880) and Manson (1881A, pp. 9, 10; 1882A, p. 55) and accepts Manson's treatment as successful.

Leuckart's (1889, pp. 404-440, figs. 181-190) discussion is chiefly zoological in nature. As stated above, Leuckart (1889, p. 408) and Nakahama, after comparing Kerbert's specimens with forms from man, consider the two worms specifically identical. Nakahama, according to Leuckart (1889, p. 437), has occasionally found the parasite in man, two or three in a cyst. Baelz in 1879 had written to Leuckart that he estimated the eggs which one of his patients, a strong man, expectorated daily as at least 12,000. The man had been sick for thirteen years. Baelz also wrote Leuckart that in a hemorrhage

caused by this parasite one of his patients had lost nearly a pound of blood in an hour.

Vincent (1889, p. 184; reprinted 1890A, p. 80) refers to the disease rather briefly, but adds no original observations. He erroneously states that Cobbold found the parasite in Formosa.

In 1887 a decidedly new element forced itself into consideration in connection with the lung fluke infection, but since the observations were published in Japanese the condition involved was overlooked by the rest of the world until 1889. It seems, according to Yamagiwa (1892, p. 448), that Otani (1887) performed an autopsy upon the cadaver of a man who had suffered from epileptic attacks and who also had *Paragonimus* infection of the lungs, as shown by his sputum. Upon postmortem it was shown that these epileptic attacks were caused by cysts in the frontal and occipital lobes of the large hemisphere; several specimens of lung worms and numerous eggs were found in the cysts. Cysts containing distome eggs were also found in the liver, the intestinal wall, the peritoneum, the diaphragm, the mesenterial and cervical glands. A year later Otani (1888) published two similar cases, but without post-mortem notes, and in December, 1891, still further cases of lung distome disease, complicated with epilepsy or with pulmonary phthisis.

Miura (1889) published a case of infection of the brain with distome eggs which Blanchard (1895) and Moniez (1896) later interpreted as belonging to the species under discussion. In September of the same year Yamagiwa and Inoui (1889) presented before the Tokyo Medical Society a case of Jacksonian epilepsy with encephalitis multiplex of the right hemisphere, the lesion being produced by emboli of lung distome eggs. The Japanese Government then sent Inoui and Yamagiwa (1890) to Okayama to investigate the lung fluke disease. Their results are summarized by Yamagiwa (1892, pp. 449-451), giving some interesting statistical data:

The region was on the side of a mountain or hill and on a small river, the latter giving the general supply of drinking water, especially in localities where patients were found. A number of epileptic patients were seen, but in none of these were lung distomes diagnosed. Of 32 patients, 26 were male, 6 female. The ages of 33 patients were: 1 to 10 years, 4; 11 to 20 years, 14; 21 to 30 years, 9; 31 to 40 years, 5; 41 to 50 years, 2; over 51 years, 1; not given, 3. Of 45 patients, 38 were peasants, 1 laborer, 1 merchant, 5 officials. Of 38 patients, 12 were drinkers. Cough and sputa increase in cold weather; distome eggs also frequently found in the stools; sputa most profuse night and morning; *Uncinaria* was present in some cases.—Abstract.

In a later article Yamagiwa (1892, pp. 446-456) gives an exceedingly interesting general discussion of the lung fluke disease in Japan, reviewing several Japanese articles which are not accessible or intelligible to the European or American worker. From this it may be gathered that after Baelz's (1880) article Drs. Kinoyo, Suga, and Yamagata had occasion in 1881 to perform a postmortem upon a

patient who had died in the Okayama hospital. They found in the superficial lung parenchym numerous specimens of living distomes which they named "*Distomum pulmonis*." In September, 1883, Dr. Nakahama published upon the structure of the parasite in question, and it appears that he succeeded in raising the eggs. Yamagiwa then gives a general account of the results of study by himself and Inoui in Okayama (see also above p. 586). He further (pp. 451, 452) gives post-mortem notes of a case,¹ patient suffering from pulmonary distomatosis, combined with infection of the brain with *Paragonimus* eggs:

Student, male, admitted to Sasaki's clinic as an epileptic; had had cough, with expectoration and hæmoptysis, but no tuberculosis; *Paragonimus* eggs found in sputum by Inoui. Patient taken with cholera in 1890; died October, 1890.

Adhesions between the lungs and the chest wall and diaphragm. Cyst, with cheesy content, found on lateral side of lower left lobe, contained one dead *Paragonimus*, numerous eggs, and Charcot's crystals; one end of this plum-shaped mass was in the adhesion, the other extended into the lung parenchym; its wall was several millimeters thick, could not be separated from the surrounding tissue; inner surface was folded and rough; close to the cyst wall were discovered dilated bronchi; no communication discovered between the cyst lumen and the adjacent blood vessels or small bronchi; indurated areas in lung parenchym near cyst. Hemorrhagic centers here and there in the tissues of the adhesions. No *Paragonimus* lesions found in cerebrum or in entrails. Upon microscopic examination, cyst wall was seen to be composed of connective tissue rich in cells; the inner surface sent fine network of fibers into cyst cavity. Blood corpuscles, pigmented epithelioid cells, and Charcot's crystals lie between the fibers and the relatively smooth inner surface; here and there *Paragonimus* eggs embedded in the cyst wall, some of them appearing to obstruct the capillaries or bronchioles. Loops of blood vessels and extensive round-cell infiltration surround connective tissue layer of cyst. In the cyst wall bordering on the lung parenchym are found alveoles and bronchioles still intact, the former filled with pigmented epithelial cells; *Paragonimus* eggs and giant cells also present; the latter are irregular in form and contain in their center, not in the periphery, many nuclei; giant cell-like structures containing *Paragonimus* eggs also present.

Yamagiwa (pp. 453-456) closes his paper with a résumé of parasitic hæmoptysis.

Since 1892, no original observations upon this disease in man appear to have been published, although the malady is discussed by several authors: Blanchard (1895, pp. 34-39; 1895, pp. 739-740), Railliet (1893, pp. 369, 370), Stiles (1894), Braun (1895, pp. 142, 143, fig. 58), Ward (1895), Mosler and Peiper (1894, pp. 178, 179), Huber (1895, pp. 576, 577), and Moniez (1896, pp. 144-152).

The following authors merely refer to the disease or the parasite in a very general way: Manson (1883C, p. 1813), Railliet (1886, p. 296), Dunglison (1893, p. 338), Simon (1896, p. 225), Sonsino (1896, p. 247, states that the parasite has not been found in Egypt), Gamble (1896, pp. 63-70), Jaksch (1897, pp. 129, 130), Simon (1897, p. 259),

¹ Published by Inoui in Bd. IV, No. 19, and Bd. V, No. 2, Zeitschrift der medicinischen Gesellschaft, Tokyo.

Weichselbaum (1898, p. 315), Schneidemühl (1898, pp. 301, 302), Vierordt (1898, p. 158), and Coplin (1898, pp. 339, 340).

Beyond a doubt it is also referred to in many other works on practice, pathology, and clinical diagnosis which we have not consulted.

The following references to the parasite are purely zoological in nature, the authors comparing the worm with other species; accordingly these references contain no medical data:

Von Linstow (1889), Poirier (1885), Braun (1892, 1893, 1899), Stossich (1892), Kholodkovski (1898), Pratt (1898), Railliet & Marotel (1898), MacCallum (1899), Looss (1899).

As stated above, the originals of the papers published in Japanese could not be read. References we have made to them are based upon Taylor (1883) and Yamagiwa (1890, 1892).

(E) LUNG FLUKES IN THE HOG (*Sus scrofa domestica*).

In September, 1898, Dr. A. J. Payne of the Bureau of Animal Industry, inspector in charge at Cincinnati, forwarded to the main office at Washington, D. C., portions of a hog's lung containing unidentified parasites. He stated that the hog was in good condition and that only the lungs were affected. The worm was immediately determined by Hassall, then Acting Zoologist, as "*Mesogonimus Westermanni*." In reply to inquiry, Dr. Payne wrote on October 28, 1898, that the origin of the infected animal could not be determined, and that on October 25, thirty-five more hogs had been found harboring this same worm in the lungs; none of the swine had more than four or five cysts. Again, on November 10, he forwarded more specimens taken from the lungs of six hogs. Careful examination had shown that about 1 per cent of the hogs killed at that station and at that time were infested with the same worm. No cases of very heavy infections were found. Ten days later, November 24, he reported that the worms had become very scarce, only two or three cases being encountered since November 14. Another infected hog was reported to the Washington office November 29; three cases December 20; one case December 21; one case January 11. On August 24, 1900, in reply to a letter of inquiry, Dr. Payne stated that in 1900 the worm had become very rare as shown by the fact that during the preceding four months only one case had been found.

Such is the information gathered from Dr. Payne's letters to the main office. Since the vast majority of hogs' lungs are "tanked" in American abattoirs, no exact statistical account is kept in our inspector's records of the number of hogs' lungs affected with animal parasites (*Echinococcus*, *Strongylus paradoxus*), but Dr. Payne has reported fifty-two cases of *Paragonimus*, and it will be noticed that for a short period he reported 1 per cent infected. This heavy infection of 1 per cent was probably due to killing quite a large number of animals which came from the same infected area. (See p. 561.)

Relative to the worm itself, the observations made at the time show that in the majority of cysts examined, two specimens occurred together; it was very rare that a cyst contained one worm only or more than two. The parasites were of a pinkish color and varied considerably in outline when alive, the difference in form corresponding to the contraction of the muscles. Upon being killed they all became a slaty gray, somewhat darker dorsally than ventrally, and usually in the median dorsal and ventral field, especially the latter, somewhat lighter in color than the other parts of the worm; this light color was due to the absence of the vitellaria from these portions. Specimens assume various shapes upon being preserved, but in general they are oval to elongate-pyriform, the anterior half being thicker, as a rule, than the posterior half. In many instances the oral pole is decidedly prominent, resembling to some extent the cephalic cone of *Fasciola*; it is surrounded by a narrow white zone from which the vitellogene glands are absent. On cross section the worm is nearly or quite round; the vitellaria form a dark peripheral zone. The dorsal surface is more convex, especially on longitudinal section, than the ventral, the latter being more or less straight from mouth to tail, though the tip of the tail is frequently turned more or less dorsad. Our largest specimens attained 14 mm. in length by 4 mm. in diameter. Measurements given by various authors are as follows:

From tiger, 7 to 9 by 6 to 4 by 2 to 3 mm., Kerbert, 1881.

From man, 8 to 10 by 5 to 6 mm., Baelz, 1883.

From cat, 11.2 to 15.5 by 4.8 to 7.7 mm., Ward, 1894, p. 362.

From dog, 15 to 20 mm., Kellicott, 1894.

From hog, 3 to 14 by 2 to 4 mm., Stiles & Hassall, 1900.

From these figures it may be noticed that the American specimens average somewhat larger than the Asiatic worms, but too much weight should not be attached at present to this point.

Of the external openings, the oral sucker, the ventral acetabulum, and frequently also the excretory pore, are prominently visible to the naked eye; the genital pore is usually quite indistinct, even under the hand lens.

The oral sucker is terminal or ventro-subterminal, according to the contraction of the body wall. As stated above, it is surrounded by a narrow white zone, free from vitellogene glands; it measures (on compressed specimens) 0.80 to 1.12 mm. broad by 0.80 to 0.83 mm. long.

The ventral acetabulum measures 0.88 to 1.2 mm. broad by 0.86 to 1.44 mm. long.

The measurements of these two structures as given by various authors are as follows:

From tiger, oral sucker 0.78 mm.; ventral acetabulum 0.78 mm., Kerbert, 1881.

From man, oral sucker¹ 0.53 mm.; ventral acetabulum 0.6 to at most 0.75 mm., Leuckart, 1889.

¹ Worm was 7 mm. long.

From cat, oral sucker ¹ 1 to 1.4 mm.; ventral acetabulum ² 0.75 to 1 mm., Ward, 1894 A.

From dog, oral sucker 0.86 to 1.017 mm.; ventral acetabulum 1.17 to 1.31 mm., Ward, 1895 B.

From hog, oral sucker ³ 0.80 to 1.12 by 0.80 to 0.83 mm.; ventral acetabulum 0.88 to 1.2 by 0.86 to 1.44 mm., Stiles & Hassall, 1900.

Here, again, it may be pointed out that the measurements of the American specimens are slightly larger than those of the Asiatic worms, but the question naturally arises as to the number and the technique of the specimens measured. Leuckart mentions that in a specimen 7 mm. in length the acetabulum was 2.3 mm. from the oral sucker. In some of our specimens, varying from 11.5 to 14 mm. long, the interval was 3.5 to 4 mm. long; in Kerbert's specimens the space was 2 to 4 mm.

The excretory pore is dorso-subterminal and is often distinctly visible to the naked eye. The genital pore may be median or directly right or left of the median line.

The cuticle is covered with an external layer, as described by Kerbert, pierced by numerous scale-like spines. In many instances this external layer is lost down to the *membrana limitans*, leaving the spines free; in other cases the spines also are lost. Regarding the size of the spines, it may be noted that Kerbert states that those on the anterior portion of the body, Leuckart that those on the middle portions, are largest. Kerbert (1881) states that the larger spines were 18 μ long by 2 μ broad at the base; the others, 10 μ long; Leuckart gives the measurements of the longest as 60 μ , with a base 14 μ broad, "as a rule, however, the free end is rounded instead of pointed, so that the length is somewhat shortened — to" 0.4 mm. [$! = 0.04$] and even shorter. In our specimens the spines in the immediate vicinity of the oral sucker are the shortest; those on the middle of the body do not show any notable difference in length from those of the caudal end, attaining 40 to 48 μ long by 12 to 20 μ broad by 4 μ thick at the base.

The difference between Kerbert's measurement on the one side and Leuckart's and ours on the other are very striking; so striking, in fact, that the thought arises in our minds as to whether Kerbert has not erred in his calculations. This explanation seems all the more probable when we consider that Leuckart reexamined Kerbert's specimens but mentioned no such difference between his and Kerbert's material. If Kerbert's measurements are correct, there can be little doubt that his parasite from the tiger represents a variety which is distinct from the one found in man and hogs. As already intimated, nothing but an actual comparison of specimens will satisfactorily settle these points. The internal organs agree essentially with the

¹Specimens distorted.

²Average of 7 specimens, 0.84 mm.

³Press preparations, 9 to 14 mm. long.

descriptions given by Kerbert for the parasite of the tiger, Leuckart for that of man, and Ward for that of the cat.

Referring to the alleged segmentation of the ovicell before oviposition, we have been unable as yet to discover it.

Of 25 eggs taken from cysts in the lungs of hogs, the measurements varied as follows: Length, 96 μ maximum, 78 μ minimum, 85.6 μ average; breadth, 60 μ maximum, 48 μ minimum, 53.2 μ average.

The measurements of the eggs given by different authors vary considerably. Thus the following figures are found:

From tiger, 80 by 45 μ , Kerbert, 1881.

From cats, 96 to 118 μ by 48 to 53 μ , Ward, 1894B.

From man (sputum), 130 by 70 μ , Baelz, 880.

From man (sputum), 85 by 51 μ , Manson, 1882.

From man (sputum), 80 to 100 μ by 50 μ , Baelz, 1883.

From man (brain), 40 to 64 μ by 24 to 40 μ (sections), Yamagiwa, 1890, p. 455.

From man (lungs), 49 to 60 μ by 29 to 36 μ (sections), Yamagiwa, 1890, p. 455.

From man, 80 to 100 μ by 50 μ , Leuckart, 1889, p. 406.

From hogs, 78 to 96 μ by 48 to 60 μ , Stiles & Hassall, 1900.

The cysts in the lungs are from 12 to 36 mm. in diameter, and contain a semifluid, chocolate-colored material, in which numerous eggs are found. In some cases there was a communication between two adjacent cysts. As a rule, these structures are superficial, but occasionally they are more deeply situated in the lung tissue. The pathology has not yet been studied.

SYMPTOMS.—In the hogs these trematodes have been diagnosed only post-mortem. The same symptoms described above for man may be expected also in hogs. For general discussion of the entire medical phase of the subject, see above, pp. 578–600.

ABATTOIR INSPECTION.—All lungs of hogs found to contain this worm should be "tanked" for fertilizer, in order to prevent dissemination of the eggs. There is, however, no danger of the direct transmission of the worm from hogs to man, since analogy with other members of the same family (Fasciolidæ) of parasites leads us to assume confidently that this species must pass through an invertebrate intermediate host (probably some mollusk) before it can infect another host. There is therefore not the slightest danger of infection from the eggs of the flukes connected with eating the pork from a hog which harbors the parasite in question, and inspectors should not, therefore, condemn the meat of such animals on the ground of the presence of the worms in the lungs. (See also *Agamodistomum*, p. 559.)

(F) PULMONARY DISTOMATOSIS IN OTHER ANIMALS.

It is by no means an uncommon occurrence to find trematodes parasitic in the lungs of cold-blooded animals. Such parasites are, for instance, frequently met with in frogs and snakes. Among the warm-blooded animals, on the other hand, while nematodes (round

worms), particularly of the genus *Strongylus*,¹ are found in the lungs, it is infrequent that trematodes (flukes) are met with in the thoracic viscera.

Cases are, however, not unknown in birds, while at least three species besides *Paragonimus Westermanii* have been recorded for mammals, namely:

Paragonimus rudis in the lungs of the Brazilian otter.

Paragonimus compactus in the lungs of the Indian mongoose, or ichneumon.

Fasciola hepatica in the lungs of cattle, sheep, goats, and camels.

(A) PARAGONIMUS RUDIS (DIESING, 1850) STILES & HASSALL, 1900, IN THE LUNGS OF A BRAZILIAN OTTER (LUTRA BRASILIENSIS).

1850: *Distomum rude* DIESING, 1850, pp. 360, 361.—ID., 1855, pp. 66, 67, tab. III, figs. 9-10.—ID., 1858, p. 341.—COBBOLD, 1859, p. 363.—ID., 1860, p. 7.—KERBERT, 1878, p. 272.—VON LINSTOW, 1878, p. 40.—STOSSICH, 1892, p. 36.—BRAUN, 1892, p. 735; 1893, pp. 876, 877.—ID., 1899, p. 492.

1879: "*Distoma rude* Diesing," in COBBOLD, 1879, p. 298.

DIAGNOSIS.—Body elliptical, thick, somewhat convex dorsally, rather flat ventrally. Mouth terminal, circular. Acetabulum same size as mouth, antero-subcentral, aperture circular. Genital pore caudad of acetabulum. Length 5 lines, width 3 lines, thickness about 2 lines.

HABITAT.—Brazilian otter (*Lutra brasiliensis*); in tissue of the lungs, encysted in pairs; September, Brazil (Natterer).²

Diesing (1850, pp. 360, 361) described as a new species (*Distomum rude*) parasites taken by Natterer from the lungs of a Brazilian otter (*Lutra brasiliensis*). His original diagnosis is given in the footnote.²

Later (1855, pp. 66, 67) he repeats the diagnosis, and adds that the worms were collected but once, in September, 1828, at Montogrosso; 14 specimens were found arranged in pairs, surrounded by fibrous cysts. His figures give only the external form, which appears to resemble preserved specimens of *Paragonimus*. The ventral acetabulum is figured as rather prominent, and as somewhat larger than the oral sucker; the genital pore is just posterior of the acetabulum, while the extensive granulation bears a close resemblance to highly developed vitellaria. Still later Diesing (1858, p. 341) merely refers to the worm. Cobbold (1859, p. 363) mentions it in connection with *D. compactum*, and twice again refers to it (1860, p. 7; 1879, p. 298) without adding any new data concerning it. Kerbert (1878, p. 272) refers to *D. rude* in connection with *D. compactum* and *D. Westermanii*. Stossich (1892, p. 36) places it among the doubtful species,

¹ In the United States, for instance, verminous bronchitis is caused in calves by *Str. micrurus*, in sheep by *Str. filaria*, in mules by *Str. Arnfieldi*, in hogs by *Str. paradoxus*. Verminous pneumonia in sheep is caused by *Str. ovis-pulmonalis*.

² "*Corpus ellipticum crassum, supraconvexiusculum, subtus planiusculum. Os terminale orbiculare. Acetabulum magnitudine oris, subcentrale superum, apertura circulari. Apertura genitalis pone acetabulum. Longit. 6''' ; latit. 3''' ; crass. ad 2'''.*"

"Habitaculum.—*Lutra brasiliensis*: in pulmonum parenchymate, gemina folliculo inclusa, Septembri, in Brasilia (Natterer). M. C. V."—Diesing, 1850, p. 360.

gives a diagnosis based upon Diesing's description, and remarks that he believes that the form is identical with *Mesogonimus compactus*.

In 1892 (p. 735) and 1893 (pp. 876, 877) Braun draws attention to the close relationship, relative to the position of the genital pore and the occurrence in the lungs, existing between *D. rude* and *D. Westermanii*. Later (1899, p. 492) Braun places this species in the genus *Paragonimus*, without making the specific combination.

It will thus be seen that the worm has been reported but once, and that no medical facts concerning it are known.

(B) *PARAGONIMUS COMPACTUS* (COBBOLD, 1859) STILES & HASSALL, IN THE LUNGS OF THE INDIAN ICHNEUMON (*HERPESTES MUNGO*).

1859: *Distoma compactum* COBBOLD, 1859, p. 363, tab. LVIII, figs. 1-3.—ID., 1861, p. 118.—ID., 1864, p. 16, fig. 2.—ID., 1879, pp. 299, 419.—KERBERT, 1878, p. 272.

1892: *Mesogonimus compactus* (Cobbold, 1859) STOSSICH, 1892, pp. 31, 36.—MONTICELLI, 1893, p. 156.

1892: "*Distomum compactum* Cobbold" in VON LINSTOW, 1878, p. 37.—BRAUN, 1892, p. 653.—ID., 1893, p. 876.—ID., 1899, p. 492.—MONTICELLI, 1893, pp. 83, 155.

DIAGNOSIS.—*Paragonimus*: "Body smooth, ovate, oblong, not compressed; oral sucker terminal, orbicular; ventral sucker subcentral, aperture triangular; reproductive pore immediately below, a little to the left. Length one-sixth to one-third inch; breadth one-eighth to one-fifth inch." Testicles globular, one behind the other, slightly nearer the acetabulum than the posterior extremity. Vitellogene glands highly developed, extending from anterior to posterior extremity. Acetabulum about same size as oral sucker, and slightly anterior of middle of the body.

HOST.—Indian ichneumon (²*Herpestes mungo*).

TYPE SPECIMEN.—Coll. Cobbold, No. 57.

Cobbold found five specimens of this trematode in "pustular cavities in the left lung of an Indian ichneumon (*Viverra mungos* L. [= *Herpestes mungo*]). * * * It is provided with a short esophageal bulb, giving off two simple, tortuous, and unusually broad digestive canals. The vitelline ceca almost entirely cover the lateral and dorsal surfaces, and are connected in the middle line by two primary transverse branches; these again unite to form a trunk which opens into the base of the short and folded uterine tube. The testes lie below." Cobbold refers to *Distomum rude* as bearing a nearer resemblance to this new form than any other species known to him. From Cobbold's figure it is quite clear that *D. compactum* is closely related to *Paragonimus Westermanii*, and that the two forms should be considered congeneric. In fig. 2 the testicles are drawn as globular.

Later Cobbold (1861, p. 118) states that the host had lived in the Societies' Gardens (London) for about twelve months. Since the par-

¹ Quoted portion is Cobbold's original diagnosis. Other characters added from Cobbold's figure.

² Synonyms: *Viverra mungo* Gmelin; *Herpestes griseus* Kelaart; *H. furrugineus* W. Blanford; *H. Andersoni* Murray; etc.

asites were apparently fresh when he examined them, and since the animal was in all probability infected before it was taken to London, it would appear that this species is able to live at least more than a year. In 1864 (p. 31) Cobbold merely mentions the worm again and copies his original fig. 2. In 1879 (p. 419) the worm is simply referred to by him in a comparison with *Campula oblonga*. Stossich (1892, p. 31) takes his diagnosis from Cobbold, gives the host as *Mungos fasciatus*, and states (p. 36) that he believes this parasite is identical with *Distomum rude*. *Mungos fasciatus* is probably *Crossarchus fasciatus* (Demarest), if from Africa. This change of host name is due to von Linstow (1878, p. 37). Braun (1892, p. 663; 1893, p. 876) merely refers to the worm in connection with reference to other forms. Later Braun (1899, p. 492) places this species in the genus *Paragonimus*, without making the specific combination.

Thus this species also has been recorded but once, and no medical facts are known concerning it.

(C) THE COMMON LIVER FLUKE (*FASCIOLA HEPATICA*) IN CATTLE, SHEEP, GOATS, AND CAMELS.

Morot found a little more than 4 per cent (101 cattle) of the 2,458 cattle inspected during six months at Troyes, France, affected with the common liver fluke in the lungs. The parasites were encysted usually in the posterior lobe of one of the lungs; they were near the surface, sometimes forming a slight projection. The cysts varied in size from being as large as a walnut to the diameter of an apple, and were globular, ovoid, or discoid. The capsule was fibrous, and sometimes encrusted with lime salts, usually closed, rarely communicating with the bronchi; smaller cysts contain a reddish, yellow, or brown sirupy fluid, the larger ones a more or less thick mass of various consistency in different cases. As a rule, each cyst contained but one fluke, rarely two; in some instances only fluke eggs were found. Regarding symptoms, Neumann remarks:

Pulmonary distomatosis is not betrayed by any appreciable symptoms; but according to Bollinger, Lydtin has witnessed a malady in a large number of cattle that began like pleuro-pneumonia, and at autopsies he found here and there in the ectasiated bronchi numerous hepatic distomes.

Similar cysts have been found in the sheep, goat, and camel. For a bibliography on the subject, see Neumann, pp. 579, 580.

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52: THE CONICAL FLUKE (*Amphistoma cervi*) OF CATTLE SLAUGHTERED IN THE UNITED STATES.

On pages 64-66, figures 49-55, of Bulletin 19, mention is made of the conical fluke which had been reported from Europe, Africa, Asia, Australia, and Canada. The United States should now be added to this geographical list. Specimens of this worm have been repeatedly collected from steers by Dr. H. A. Christmann and by Dr. G. A. Johnson, Bureau of Animal Industry, assistant inspectors at Sioux City, Iowa. The origin of the steers was not determined. Many Canadian cattle are slaughtered at this point, and it is not impossible that the infected animals were of Canadian origin.



FIG. 29.—Dorsal view of a conical amphistome, showing the anatomical characters: *a*, position acetabulum; *ex*, terminal vesicle of excretory system; *i*, intestinal caeca; *Lc*, Laurer's canal; *oc*, oesophagus; *ov*, ovary; *ph*, pharynx; *t*, testicles; *u*, uterus; *vd*, vas deferens; *vdt*, vitellogenic duct; *vs*, vesicula seminalis X5. (After Otto, 1896, p. 100, fig. 4.)

OUR PRESENT KNOWLEDGE OF THE KIDNEY WORM (*SCLEROSTOMA PINGUICOLA*) OF SWINE.

By LOUISE TAYLER, B. A., M. S.,

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INTRODUCTION.

In many sections of the United States in which hogs are raised one frequently hears farmers complain that their hogs are "affected with kidney worms." Indeed, many farmers go so far as to pronounce a positive diagnosis of kidney worm when they notice that their animals are not in a good state of health. Common as the parasite is, it appears never as yet to have been made the subject of careful study. Under these circumstances, the writer has acted upon the advice of Dr. Stiles and brought together all the scientific literature obtainable upon the subject. To this historical review certain original anatomical observations have been added.

The so-called kidney worm of hogs (*Sclerostoma pinguicola*) should not be confounded with the kidney worm (*Diocotophyme viscerales*) of dogs and man. Both of these parasites belong to the same zoological family (Strongylidæ), but to different subfamilies and genera. The kidney worm of dogs grows to a length of 1 to 3 feet. The kidney worm of hogs is much smaller, attaining at most something less than 2 inches in length.

The parasite now under discussion belongs to the subfamily Sclerostominae, genus *Sclerostoma*. It appears to have been first collected in South America by Natterer; it was first scientifically described by Diesing under the name *Stephanurus dentatus*, but, for reasons explained further on, this name can not hold. The correct zoological binomial for the parasite is *Sclerostoma pinguicola*.

The body of the worm is plump, mottled in color—red, yellow, white, black—according to the organs visible beneath. The average female is about 37 mm. and the average male 32 mm. in length. The worms seem to occur in pairs, usually in cysts or canals; thus, upon the examination of two kidneys with their surrounding fat, fifteen specimens were found, seven males and eight females. Later, twelve kidneys with their surrounding fat were examined, and the observations made on the first pair of kidneys dissected were confirmed. The connective tissue layers between the fat were found to be the most general seat of infection, and the cysts were numerous and closely packed together. Although a cyst usually contained two worms, a male and a female,

ometimes three were found together, two females and one male, or just as often one female and two males. Twice only did the writer find this plan to vary, when five were found in each of the two cysts—three females and two males. The cysts contained pus, which bathed the parasites, and in which were thousands of eggs in the segmentation stage. Still other cysts, upon being cut into, were found without parasites and in a necrotic condition.

It will be noticed that *Sclerostoma pinguicola* is colloquially known as the kidney worm. In no case, however, has the writer found it in the kidney substance, but only in the tissue surrounding this organ; the lard appears to be its *normal* habitat, at least.

Of the thirty-one drawings accompanying this work all were made from fresh specimens by the writer except figs. 30 and 31, which were executed by Mr. W. S. D. Haines, artist of this Bureau. Literature



FIG. 30.—Leaf lard around kidney of hog.

references were obtained partly from the card catalogue of the Zoological Laboratory of the Bureau of Animal Industry.

TABLE OF SYNONYMY.

Sclerostoma pinguicola VERRILL, 1870.

- 1839; *Stephanurus dentatus* DIESING, 1839, Ann. Wien. Mus., II, pp. 232, 233, Pl. xv, figs. 9-19.—DUJARDIN, 1845, Hist. nat. helminthes, p. 289.—DIESING, 1851, Systema helminthum, II, pp. 296, 297.—WHITE, J. C., 1858, Proc. Boston Soc. Nat. Hist., VI, p. 428.—DIESING, 1861, Sitzungs. d. Math.-Naturwiss. Cl. d. Kaiserl. Akad. d. Wissensch., XLII (28), p. 718.—ID., 1861, Sitzungs. d. Math. Naturwiss. Cl. d. Kaiserl. Akad. d. Wissensch., XLIII, I, pp. 231, 232.—MOLIN, 1861, Mem. Institute Veneto Sci., Lett. ed Arti., IX, pp. 12, 162, 163.—CARUS, 1863, Handbuch der Zoologie, II, p. 464.—FLETCHER, 1871, Amer. Journ. Science and Arts, 3d series, I (whole number, CI), pp. 435-437.—CORBOLD, 1871 (Jan.), British Med. Journ., I, pp. 50, 51.—ID., 1871 (Sept.), British Med. Journ., II, p. 394.—ID., 1871 (Oct.), Nature, IV, pp. 508, 509.—ID., 1871 (Nov.), Monthly Microscop. Journ., VI, p. 245.—MORRIS, 1871 (Nov.), Month. Microscop. Journ., VI, pp. 243, 244.—LEUCKART, 1879, Die Parasiten des Menschen, Bd. I, Lief. 1, 2. Aufl., pp. 60, 180.—ZÜRN, 1882, Die tierischen



FIG. 31.—*Sclerostoma pinguiicola*. External view of female. a, male, natural size; b, female, natural size;

c, mouth; d, buccal cavity; e, esophagus; f, intestine; g, anus; h, genital opening; i, cephalic gland.

Parasiten, p. 278.—LEUCKART, 1886, The Parasites of Man [Translated by W. E. Hoyle], pp. 46, 141.—LUTZ, 1886, Deutsche Zeitschrift für Thiermedizin u. vergleichende Pathologie, Bd. XII, p. 62.—RAILLIET, 1886, Éléments Zoologie médicale et agricole, pp. 355, 356.—NEUMANN, 1888, Traité des Maladies parasitaires, pp. 485, 655.—Id., 1892a, Traité des Maladies parasitaires, 2ed., pp. 535, 536, 746.—Id., 1892b, Parasites and Parasitic Diseases of Domesticated Animals, pp. 551, 552, 769.—DINWIDDIE, 1892, Journ. Comp. Med. Vet. Archives, XIII, pp. 342-344.—RAILLIET, 1886, Éléments Zoologie médicale et agricole, pp. 355, 356.—Id., 1893, Traité Zoologie médicale et agricole, I, pp. 452, 453.—STILES & HASSALL, 1894, Vet. Mag., I, p. 345.

1870: *Sclerostoma pinguiicola* VERRILL, 1870, Report Conn. Board Agric. (1869), pp. 248, 249, figs. 83 a-d.—Id., 1870, Parasites of Domestic Animals, pp. 137, 138, figs. 83 a-d.—Id., 1870, Amer. Journ. Science and Arts, 2d series, L (whole number, C) (149), Sept., pp. 223, 224, figs. 1 a-d.—WARD, 1895, The Parasitic Worms of Man and the Domestic Animals, p. 308.—RAILLIET, 1896, Recueil Med. vét., 7. sér., III (5), p. 160.—TAYLER, 1900, Sixteenth Annual Report Bureau of Animal Industry, U. S. Department of Agriculture, pp. 612-637, figs. 30-45.

1874: *Strongylus dentatus* DEAN [nec Rudolphi, 1803], 1874, Seventh Annual Report of Board of Health of City of St. Louis, pp. 62, 63.

1879: *Stephanurus Nattereri* COBBOLD, 1879, Parasites; a Treatise on the Entozoa of Man and Animals, pp. 407-412.

1894: *Strongylus (Sclerostomum) pinguiicola* (VERRILL) MAGALHÃES, 1894, Centralb. f. Bakteriöl. u. Parasitenk., XVI (7), pp. 292-297, 1 fig.—Id., 1894, Centralb. f. Bakteriöl. u. Parasitenk., XVI, (20), p. 821.

SPECIFIC DIAGNOSIS.

SCLEROSTOMA.—Body cylindrical, tapering but slightly at each end; mottled in color; mouth terminal, circular, provided with six papillæ, of which the dorsal and the ventral are more

prominent than the four submedian, and with numerous cilia-like structures, about 35-40 in number. Cuticle thicker at extremities than in middle of body; transverse rings broader at extremities ($9\ \mu$) than in the middle ($3\ \mu$) of body. Opening of cephalic gland on ventro-median line near anterior end of esophagus. Alimentary tract with distinct regions; buccal cavity ball-shaped, with ten enlargements at base; esophagus distinct, Indian-club shaped; stomach intestine greatly convoluted.

Male: 25 to 37 mm. in length by $1\frac{1}{4}$ mm. in width. Anus at caudal extremity. Inconspicuous rectangular bursa; lobes 6:

dorsal 2, latero-dorsal 2, latero-ventral 2. Each half of bursa, 9 rays, arranged: dorsally 3, 1, dorso-lateral 3, ventro-lateral 2. Spicules 2, equal, saberform, ca. 0.8 mm. long; vesiculæ seminales 2; vasa deferentia 2, and testicles 2; each vas deferens with one testicle forming a long, white, convoluted tube about 26 mm. in length.



FIG. 33.—Anterior extremity, lateral view, showing slightly ventral position of mouth and position (X) of external opening of cephalic glands.

Female: 37 to 40 mm. in length by 2 mm. in breadth. Tail curved, obtuse, except for a conical tip. Lateral cuticular wings at caudal extremity. Anus ventral, 0.64 mm. from caudal extremity. Vulva 1 mm. forward from anus. Uteri 2, vagina bicornate. Ovaries 2, oviducts 2, each ovary with one oviduct forming a long, white, convoluted tube ca. 280 mm. in length. Oviparous; eggs oval, $56\ \mu$ by $100\ \mu$, shell thin and smooth.

Host.—The domesticated hog (*Sus scrofa domestica*), encysted in lard and kidneys.

Geographical distribution.—North and South America and Australia.

HISTORICAL REVIEW.

The worm now under consideration appears to have been described first by Diesing (1839, pp. 232, 233). Besides determining it as a new species he took it as type of a new genus, *Stephanurus*, using the specific name *dentatus*. His generic diagnosis is as follows:

Corpus teres, elasticum, antice magis attenuatum. Apertura oris ampla, sub-orbicularis, obsolete sexdentata, dentibus duobus oppositis validioribus. Cauda

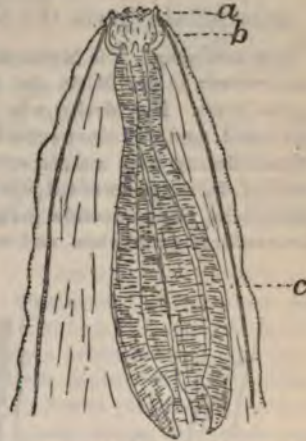


FIG. 32.—Anterior end of worm, including esophagus. a, mouth; b, buccal cavity; c, esophagus.



FIG. 34.—Oral opening showing six papillae.

maris recta, laciniis quinque coronata, membrana junctis. Spiculum terminale simplex, conulis tribus interceptum, prominulum. Feminae cauda inflexa, obtusa, apice rostrata, utroque latere processibus obtusis notata.

Diesing also gives the following specific description:

Beschreibung. Die Männchen sind etwa 10-13, die Weibchen 15-18 Linien lang, die ersteren in der Mitte des Körpers kaum eine Linie, letztere hingegen fast $1\frac{1}{2}$ Linie breit. Der drehrunde Leib gegen das Schwanzende verdickt, schwach geringelt, und mit einer scharfen Linse betrachtet, mit Hautporen versehen. Die Mundöffnung weit ausgesperirt, fast kreisrund und am Rande mit sechs Zähnen besetzt, darunter zwei entgegenstehende grösser und stärker als die übrigen.—Das männliche Schwanzende gerade ausgestreckt, von fünf lanzettförmigen Lappen kronenförmig umgeben, und sämtliche Lappen vom Grunde bis zur Spitze durch

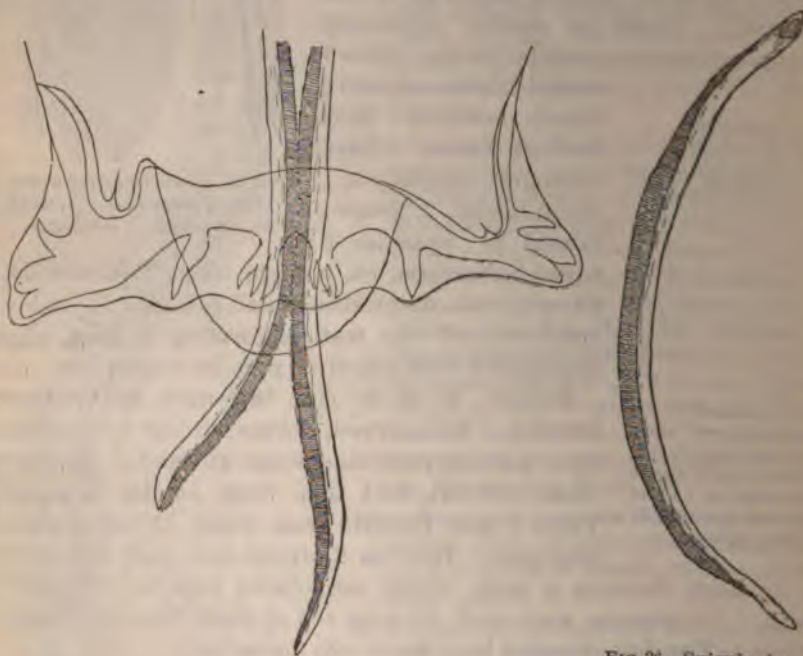


FIG. 35.—Bursa of male, with spicules.

FIG. 36.—Spicule showing fringe-like edge.

eine feine durchscheinende Membran verbunden. Das einfache, an der äussersten Schwanzspitze liegende Spiculum, von drei kegelförmigen Körpern umgeben, steht etwas hervor. Das weibliche Schwanzende umgebogen, abgerundet, und am äussersten Ende in eine gerade schnabelförmige Spitze verlängert, zu beiden Seiten des stumpfen Schwanzendes kurze blasenförmige Erhöhungen. Die weibliche Geschlechtsöffnung liegt am Anfange der zweiten Hälfte des Leibes. Diese Gattung erinnert nach dem äusseren Charakter noch am meisten an *Strongylus*.¹

¹After naming the parasite *Stephanurus*, on account of the coronet-like figure of the tail of the male, and giving a technical description of the species, he (Diesing) continues as follows:

"At Barra do Rio Negro, on the 24th of March, 1834, Natterer discovered this

The above description, which differs materially from accounts given by later authors, was supplemented by a more detailed discussion of the internal organization of the worm.

Cobbold alone quotes Diesing's description, but a much earlier reference to his work is made by Dujardin, in 1845, only six years after the appearance of Diesing's original article. This author (Dujardin, 1845, p. 289) had evidently not studied the worm, but gave the following diagnosis, based upon Diesing's publication:



FIG. 37.—Buccal cavity from in front. a, cilia-like margin of the mouth; b, orifice between buccal cavity and mouth; c, papilla.

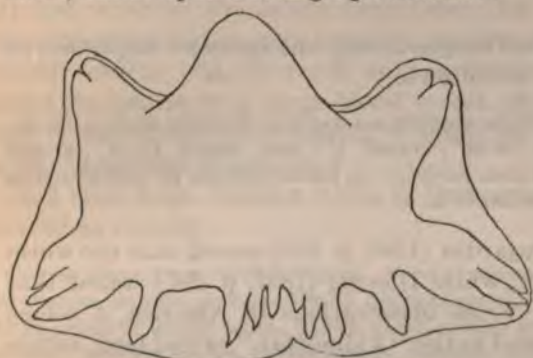


FIG. 38.—Bursa of male spread out.

Mâle long de 22 à 30 mm, large de 2 mm, 2. Femelle longue de 34 à 40 mm, large de 3 mm, 37.

Vers à corps cylindrique, élastique, plus aminci en avant; bouche grande, presque orbiculaire, à six dents peu marquées, dont deux apposées plus fortes; mâle à queue droite, couronnée par cinq lobes que réunit une-membrane; spicule terminal simple, saillant entretrois papilles coniques; femelle à queue infléchie obtuse, terminée par une pointe (un rostre) et portant de chaque côté un tubercule obtus.

peculiar genus occurring singly or several together in capsules situated among the layers of fat in a Chinese race of *Sus scrofa domestica*. Placed in water or in spirits of wine they stretched themselves considerably and almost all moved up and down.

"The males measure from 10 to 13 lines in length, the females from 15 to 18 lines, the former being scarcely a line in breadth at the middle of the body, whilst the latter are almost a line and a half in thickness. The curved body thickens toward the tail, is transversely ringed, and, when viewed with a penetrating lens, is seen to be furnished with tegumentary pores. The oral aperture opens widely and is almost circular. It is supplied with 6 marginal teeth, two of which, standing opposed to one another, are larger and stronger than the rest. The tail of the male, when evenly spread out, is surrounded by a crown of 5 lancet-shaped flaps; the combined flaps being connected together from base to apex by means of a delicate transparent membrane. The single spiculum, situated at the extreme end of the tail, projects slightly forward, being surrounded by 3 skittle-shaped bodies. The tail of the female is curved upon itself, rounded off, and drawn out at the extreme end into a straight, beak-shaped point, whilst to both sides of the stumpy caudal extremity of the body short vesicular elevations are attached. The female generative opening occurs at the commencement of the second half of the body.

"Judging by its external characters this genus is most closely allied to *Strongylus*."—Cobbold, 1871, pp. 508-509.

Trouvé au Brésil, isolément ou plusieurs ensemble dans des kystes du mésentère d'un cochon (*Sus scrofa*) de race chinoise.¹

Diesing (1851, pp. 296-297) six years later again referred to this parasite, retaining it as a distinct genus, under the following diagnosis:

Corpus subcylindricum, retrorsum sensim increscens. Caput corpore continuum. Os terminale orbiculare amplum, limbo corneo annulari dentato. Extremitas caudalis maris recta, bursa terminali laciniata, laciniis 5 membrana junctis, pene filiformi papillis conicis tribus circumvallantibus amplexo; feminae inflexa, obtusa, apice rostrata, utroque latere processibus brevibus obtusis notata, apertura genitali retrorsum sita. Pachydermatum endoparasitæ in lardo obvia.²

As previously, he placed in this genus only one species—*Stephanurus dentatus*—and described it as follows:

Caput apice truncatum; oris limbo obsolete sex-dentato, dentibus duobus oppositis validioribus. Longit. mar. 10-13", crassit. 1"; fem. longit. 15-18", crassit. 1 1/4".—Habitaculum: *Sus scrofa dom. varietas*; in lardo, solitarie vel plura capsula inclusa, Martio, in Brasilia (Natterer) M. C. V.³

It will be noticed that Dujardin (1845, p. 289) stated that the worm was found in the mesentery, while Diesing (1851, p. 297) stated that it was found "in lardo." From observations in America it seems probable that Diesing referred to the "kidney fat," or leaf lard, rather than the mesentery as habitat for the worm.

J. C. White (1858, p. 428) is the first investigator recorded as having found this worm in North America. Specimens and figures were exhibited by him before the Boston Society of Natural History. The parasites were found in the leaf lard, where, by burrowing, they had

¹ The worm with a cylindrical elastic body, thinner in front; mouth large, nearly round, has 6 slightly marked teeth, of which 2, opposite each other, are larger. The male with a straight tail, crowned by 5 lobes joined by a membrane; spicule simple, terminal, projecting between 3 conical papillæ. The female with a blunt tail bent inward, terminated by a point (a rostrum) and bearing on each side a blunt protuberance. Male 20-30 mm. long, 2.2 mm. wide; female 34-40 mm. long, 3.37 mm. wide. Found in Brazil, isolated or several together in cysts in the mesentery of a hog (*Sus scrofa*) of Chinese breed.

² Body subcylindrical, gradually increasing in size backward. Head continuous with body. Mouth terminal, large, round, edged with a horny toothed ring. Caudal extremity of male straight, with terminal lobed bursa, 5 lobes joined by a membrane, penis filiform, surrounded by 3 encircling conical papillæ; tail of female bent inward, blunt, with beaked apex, provided on each side with short blunt processes, genital aperture posterior. Endoparasites observed in the lard of pachyderms.

³ Head ter-
2 op-

th edge of mouth slightly dentated in 6 places, marked. Male 10 to 13 lines in length, 1 line in width. Female 14 to 18 lines in length, 1 1/4 lines in width. Habitat: *Sus scrofa* var. alba, in a cyst, March, in Brazil, by Natterer.

formed canals 3 or 4 mm. in diameter; these canals terminated in cysts. The cavities were filled with pus, each containing one male and one female worm. The oviparous female was described as twice the size of the male and as bent back on herself almost double. The bodies in both sexes were pale yellow, mottled with black, and reddish at the extremities. The eggs were found in all stages of segmentation. Dr. White decided that the worm was undoubtedly a "*nematoidea*" and identified it with Diesing's *Stephanurus dentatus*. He implied in the title of his paper that this species might be identical with *Sclerostoma dentatum* (Rudolphi); this fact possibly accounts for his saying that the worm was found in the liver of the hog, for Leidy (1856, p. 54) had reported the latter form from this habitat. White stated that "whether the embryo inhabits another part or not it is not ascertained, for the mature worm only is known." They were situated along the course of a large blood vessel, and he thought "no doubt gained their situation by boring through the circulatory system while in the embryonic condition."

In a later work Diesing (1861, p. 718) revised his generic diagnosis to read as follows:

Corpus elongatum, teretiusculum. Caput corpore continuum, strictum, antice truncatum, annulo chitineo limbo denticulato cinctum. Os terminale. Extremitas caudalis maris recta, bursæ quinquelobæ lobis membrana junctis, pene filiformi papillis conicis tribus cincto; feminae, inflexa, obtusa, apice rostrata, utroque latere processibus brevibus obtusis notata, apertura genitali retrorsum sita; uterus bicornis. Ovipara. In pachydermatum lardo endoparasita.¹

Still later this same author (1861, p. 281) merely referred to the worm as described in his earlier works and, in addition, referred to the above-mentioned article by Dr. White.

Molin (1861, pp. 12, 162, 163) examined the specimens first studied by Diesing. He verified the work of the former writer on the external structure, but states that the material was very poorly preserved.

He then proposed the following as revised generic diagnosis:

Os terminale, amplum, suborbiculare, dentatum; corpus teres, antrorsum attenuatum; extremitas caudalis maris recta, bursa genitali terminali laciniata, laciniis membrana conjunctis, ex qua epistomium; penis simplex, terminalis, filiformis, papillis conicis tribus circumvallantibus amplexus; extremitas caudalis feminae, inflexa, rostrata in apice, utroque latere processibus obtusis notata;

¹Body elongated, rather slender. Head continuous with body, straight, truncated in front, surrounded by a chitinous ring with a denticulate edge. Mouth terminal. Caudal extremity of male straight, with lobes of a 5-lobed bursa united by a membrane, penis filiform, surrounded by three conical papillae; tail of female, curved, blunt, with beaked extremity, provided with short blunt processes on each side, genital aperture posterior; uterus bicornate. Oviparous. Endoparasites in the leaf lard of pachyderms.

apertura vulvæ in posteriori corporis parte; vagina tubulosa, longa; uterici bicornis. Mammalium endoparasita.¹

The specific characters were given by him as follows:

Caput corpore continuum, apice truncato; es terminale, orbiculare, ampli limbo corneo anulari dentato dentibus sex obsoletis, quorum duo oppositi diiores; corpus subcylindricum, transversim anu'atum, retrorsum incrasso extremitas caudalis maris bursa genitali terminali laciniata; laciniis quinque membrana junctis, ex qua epistomium conico truncatum; penis terminalis, simplifiliformis, papillis conicis tribus circumvallantibus amplexus; extremitas caudæ feminæ inflexa, obtusa, apice rostrata, utroque latere processibus brevibus obnotata; apertura vulvæ in posteriori corporis parte; vagina longa, tubulosa; uterus bicornis. Longit. mar. 0.022-0.028; crassit. 0.002. Longit. fem. 0.033-0.040; crassit. 0.003.²

Carus (1863, p. 464) added nothing to the knowledge already obtained in connection with this parasite.

Verrill (1870, pp. 179, 248, 249) described as a new species a round worm which he named *Sclerostoma pinguicola*. The parasites have been obtained in one case of Dr. M. C. White, of New Haven, and in a second case of Dr. N. Cressy, of Middletown, Conn. He distinguished such characters as enabled him to give the following diagnosis:

The body is rather robust, especially in the female, and tapers to both ends. The color is yellowish white, and the integument is seen to be finely striated transversely when considerably magnified. The head is smaller than the body, truncated at the end. The mouth is terminal, roundish, or somewhat angular, surrounded by the thickened rim of the chitinous capsule or pharynx. This chitinous ring rises at intervals into four to six denticles or very small teeth, which correspond to thickened longitudinal, chitinous bands, that strengthen the pharynx and give a slightly angular form to the mouth. The pharynx itself is small, short, and rather squarish when seen in profile, and has three or four small, conic teeth at the bottom. The esophagus is thick, club-shaped, and very muscular.

The male is 1.12 inches long and about .05 of an inch in diameter, the tail ends in a small, blunt lobe, united with two small, entire membranous expansions, one on each side, forming a small bursa, which is strengthened by several short rays; the exact number of which could not be determined in my specimens. There are

¹ Mouth terminal, large, suborbicular, dentated; body round, attenuated anteriorly; caudal extremity of male straight, a terminal lobed genital bursa, lobes joined by a membrane, from which arises the epistome; penis single, terminal, filiform, surrounded by three conical, encircling papillae; caudal extremity of female bent inward, beaked at apex, provided on each side with blunt processes; opening of vulva in back part of body; vagina tubular, long; uterus bicornate. Endoparasites mammalia.

² Head continuous with body, truncated apex; mouth terminal, circular, large, edged with a horn-like ring, dentated, with six slight teeth, of which two opposite each other are stronger; body subcylindrical, transversely ringed, increasing in size posteriorly; caudal extremity of male with terminal lobed genital bursa; five lobes joined by a membrane, from which arises a truncated conical epistome; penis terminal, single, filiform, surrounded by three conical, encircling papillae; caudal extremity of female bent inward, blunt, with beaked apex, provided on each side with short, blunt processes; opening of vulva in posterior part of body; vagina long, tubular; uterus bicornate. Male, 0.022-0.028 mm. in length, 0.002 mm. in width; female, 0.033-0.040 mm. in length, 0.003 mm. in width.

two long, slender spicules. The females are 1.25 to 2 inches in length, and, as flattened between glass, they are .10 to .13 of an inch in breadth. The posterior end suddenly and obliquely narrows to a small conical point, which is turned to one side. The anal opening is close to the end, and the genital orifice appears to be adjacent to it. The oviducts are long, voluminous, much convoluted, and unite in a large and capacious uterus, which fills most of the cavity of the body near the posterior end. The uterus and oviducts are both filled in the larger specimens with immense numbers of small oval eggs.

It is probable that this parasite is by no means uncommon.

Verrill did not make any reference to former descriptions of a similar worm. Evidently the articles by Diesing and the observations by White and Molin had escaped his attention, or he accepted as correct the statements by Diesing and Molin relative to the single spicule and the position of the vulva.

This renaming of the parasite, together with the finding of more such worms, produced quite an amount of literature on the subject during the following year. Fletcher (1871, pp. 435-437) received, in 1866, specimens from a farmer whose hogs were dying of alleged hog cholera. Little cysts containing worms were said to have been found in the lungs, liver, and bronchial tubes. He concluded that the parasite was *Filaria bronchialis* of Owen or *Strongylus bronchialis* of Cobbold. In November, 1870, he observed a worm an inch and a half in length in the liver, and upon further examination found these entozoa in the portal veins as well as in the liver itself. Fletcher was convinced that these worms were like those brought to him four years before, and finding them oviparous, concluded they could not be *Filaria bronchialis*. The author stated that he was not able to find the helminths in an immature state, and concluded that the eggs therefore had to pass through another host before entering the swine to develop into a sexually mature worm. This kidney worm was held responsible, he said, for a "paralysis of motion in the hind legs"—a very widespread view among American farmers—but Fletcher did not consider the case as proved until its existence in a cerebro-spinal center should be demonstrated. His description of the worm was as follows:

Structure.—The head and oral cavity are alike in male and female. The oral cavity is rather oval than round, and is surrounded by a hexagonal frame, each corner having a papilla and hooklet, while each side is armed with six serrate teeth.

Looking into the oral cavity, it is funnel-shaped, having three openings at the back, one of which connects directly with the esophagus, while the others appear to connect with the water vessels.

The intestine is long and contains some pigment granules, arranged in dendritic forms, throughout its length. The whole is thrown into convolutions, and gives an almost black appearance to the worm, except when the white oviducts distended with eggs or the seminal vessels of the male are folded over the intestines, when it has a white, mottled appearance.

The caudal extremity of the female is spindle-shaped, but has two little bursæ higher up. In the male it is formed by three-lobed bursæ, above which are two well-developed, flexible spicula.

Cobbold (January, 1871, pp. 50, 51) called attention to a prevalence of helminthic disorders among the domesticated animals. The immediate cause for this statement was the receipt of a letter containing fragments of one or more parasites from Dr. Fletcher, of Indianapolis, Ind. They were at once seen to have strongyle characters and later were recognized as *Stephanurus dentatus* Diesing. Instead of being found singly and in the fatty tissue alone, Dr. Fletcher seemed to have found them in numbers in the "kidney, bronchi,¹ and portal veins" most frequently. Likewise he found "little cysts in the pyramids of the kidney" and "excavations in the lobules of the liver containing great numbers of the eggs." Cobbold did not know of the worms found by Dr. J. C. White, nor of those in the possession of Professor Verrill, obtained through Drs. M. C. White and Cressy, for he said that he knew of none that had been met with since *Stephanurus* was first described. Later, however (September, 1871, p. 394), he called attention to Verrill's description "supposing it to be a new species" under the name of *Sclerostoma pinguicola*. He still overlooked the fact that White had found it in 1858.

The same author (Cobbold, 1871, Nov., pp. 243-245) reported to the Royal Microscopical Society upon some preparations of intestinal worms from Australia sent by William Morris, of Sydney. Since part of the letter sent by Morris accompanying the parasites referred to the first observation in Australia of the helminth under discussion, it may be interesting to quote a portion here. Morris writes:

* * * Within the last few days another new worm has been sent me to investigate, its habitat being in the fat (or flip) surrounding the kidney of the pig. I have sent you six different preparations, a male and female; caudal extremity of the male showing cup-like bursa with a double (V-shaped) spiculum; head showing oral orifice with six papillae leading into the esophagus; the papillae are armed with minute lancet-pointed teeth; also two preparations showing the different stages of the development of the eggs. * * * It is about $1\frac{1}{4}$ inches in length, the male being somewhat less than the female. It is found in the fat in a free and encysted state, the encysted state being its final stage of existence. When once it becomes encysted the solid parts of the worm ultimately disappear, leaving a grayish brown fluid containing thousands of eggs. No. 17 are the eggs when the worms (generally from three to six found in a cyst) are beginning to break up. No. 18 are the worms when the eggs have entirely disappeared. The cyst from which this specimen was taken was of about $1\frac{1}{2}$ inches in length and one-half inch in diameter. By carefully examining this specimen you will see that the contents of the egg case are already taking on the characteristic features of young worms. Probably in a few days more these young worms would soon have been so far developed as to undertake an independent existence in the flesh of their host. * * *

Examine this female and you will find its intestinal and uterine canals looped up into a series of convolutions.

¹ It is very probable that the worms from the bronchi were *Strongylus paradoxus*, certainly not *Sclerostoma pinguicola*.

Cobbold adds:

* * * By far the most interesting parasite is the form which I have unhesitatingly referred to the hitherto little-known *Stephanurus*, first discovered by Natterer some thirty-five years since in Brazil. This helminth has recently been found abundantly in the pigs of the United States, where it has been generally regarded as an entire new species of entozoon. Professor Verrill, of Yale College, Connecticut, has thus been led to describe it under the new name of *Sclerostoma pingicola*; but the specific and generic titles assigned to the worm by Diesing in the *Annalen des Wiener Museums* for 1839 must, of course, be allowed to hold priority.

This conclusion of Cobbold regarding the nomenclature of the species will be shown later to be erroneous.

Cobbold (October, 1871, pp. 508, 509) desired to call attention more fully to this *Stephanurus dentatus*. After repeating his statements already recorded, he gave a full account of Diesing's description. (See footnote, pp. 616, 617.) He then referred to Fletcher's work, and added that the five specimens sent to Dr. Verrill by Dr. M. C. White, of New Haven, and not Fletcher's worms, appeared to be the first seen in America. He had not yet discovered that Dr. J. C. White had exhibited specimens and figures nearly fifteen years before. Dr. Fletcher thought, among observations which Dr. Cobbold considered of the highest importance, that this parasite was the cause of hog cholera. The latter even endeavored to prove Dr. Fletcher's opinions, and reported that Dr. Morris and Dr. Fletcher had independently arrived at similar conclusions in diagnosing the disease in swine.

Zoological Record (1873, p. 452) mentions this kidney worm, but adds nothing to the knowledge already obtained.

Dean (1874, pp. 62, 63), in an interesting article which has been quite generally overlooked by helminthologists, records this parasite from hogs killed in St. Louis, Mo. His account of the worm reads as follows:

Another worm (*Strongylus dentatus*), about an inch in length and one-sixteenth of an inch in diameter, was found in nearly every hog, in the leaf lard around the kidneys, in the pelvis of the kidneys, and especially in the depths of the walls of the first third of the ureters, and sometimes in other parts, as in the spleen. Usually found in pairs in several extemporized or excavated sacs, they are sometimes found together in considerable numbers.

They have been looked upon by some in this country as the cause of hog cholera and in Australia as the cause of a similarly fatal disease. The sacs usually contain some, often a good deal, of pus and many ova. I sometimes found the ova with desquamated epithelium of the tubuli in the pelvis of the kidney and in the urine when I saw no strongyli in these places. I found no intermediate stages. In an attempt to rear the embryos from the ova in water the eggs decomposed and broke up, and it is probable that they are developed in another host. Common caution would suggest that the kidneys and spleens of slaughtered hogs should not be thrown where swine and other animals can have access to them, and that the meat should be kept as free as possible from the contents of these sacs.

It will be noticed that Dean used the binomial *Strongylus dentatus*. His account of the habits of the parasite clearly shows that he was dealing with the kidney worm (*Sclerostoma pinguicola* seu *Stephanurus dentatus*); but as he gives no bibliographic references it is impossible to tell whether he thought he was dealing with Diesing's form or with the worm described by Rudolphi in 1803 as *Strongylus dentatus* (*Esophagostoma dentatum*), found in the intestinal tract of hogs—another excellent illustration of the necessity of the principle, "Once a synonym, always a synonym!"

Cobbold (1879, pp. 407-412) gave a historical sketch similar to his works already quoted. The only addition (except for another synonym) is his recognition of Dr. J. C. White's work in 1858.

Lutz (1886, p. 62), Zürn (1882, p. 278), Leuckart (1886a, pp. 60, 189; 1886b, pp. 46, 141), Neumann (1888, pp. 485, 655; 1892a, pp. 535-536, 746; 1892b, pp. 551-552, 769), and Railliet (1886, pp. 355-356; 1893, pp. 452-453) do not add anything new to the statements mentioned above.

Dinwiddie (1892, pp. 342-344) reports these worms in the liver, with such pathological conditions as cavities filled with pus, and, leading from them, tracts indicating the wanderings of the parasite. He did not consider the parasite injurious to the host, but added that "as hog's liver is, in most communities, a marketable commodity, this source of loss, taken collectively, must be considerable in regions where the disease is so common as it appears to be here" (Arkansas).

Stiles & Hassall (1894, p. 345) simply cite the parasite in their "catalogue" as common in the United States.

Magalhães (1894, pp. 292-297, 821) received some worms at Rio de Janeiro from one of his former students at S. Paulo. The size of the parasite, the host, the organs in which they were situated, and the country in which they were found all pointed to their being "*Stephanurus dentatus*." Upon examination of the worms, however, he came to the conclusion either that he had to deal with another genus or that Diesing's description was not entirely correct. His description of the worm was as follows:

Die Nematoden, welche ich vor mir hatte, waren von cylindrischer Gestalt; bei zweien davon, einem Männchen und einem Weibchen, ist der Körper nach vorn verschmälert; die beiden anderen dagegen, eines von jedem Geschlechte, waren im Gegenteil nach hinten dünner. Der Mund ist kreisförmig; er folgt auf eine Höhlung, deren Umkreis ein wenig unter seinem Rande mit sechs kleinen, paarweise gestellten Zähnen versehen ist. Die Mundöffnung liegt von der Längsachse des Körpers des Nematoden ein wenig entfernt, indem das Kopfende ein wenig gebeugt ist.

Das Schwanzende des Weibchens ist stumpf, endigt aber in eine mediane, schnabelförmige Spitze; an jeder Seite findet sich eine grosse Anschwellung von blasigem Aussehen. Der Schwanz des Männchens ist nicht ganz gerade; an seinem Ende ist er ein wenig gekrümmt. Die ziemlich stark entwickelte Bursa ist mehrlappig; sie besitzt 5-6 symmetrisch angeordnete Lappen. Zwei von den Rippen der Bursa sind dreitheilig, zwei andere zweitheilig, die übrigen einfach. Ihre genaue Untersuchung

verlangt eine vollständige Entfaltung der Bursa, was ich nicht habe erreichen können. Da ich die vollständigen Exemplare, welche ich besass, nicht aufopfern wollte, musste ich zur Untersuchung der Einzelheiten die erhaltenen Fragmente benutzen. Es ist sehr leicht, das Vorhandensein von zwei einander ähnlichen und gleichmässig entwickelten Spicula festzustellen; diese Organe sind sehr schwach gekrümmt, fast gerade; ein jedes ist von einer blätigen, hyalinen Kapsel umgeben. Die Spicula zeigen in ihrer ganzen Länge, mit Ausnahme ihres leicht aufgetriebenen, spindelförmigen Endes und der Umgebung desselben auf den Seiten ihrer leichten Krümmung, einen schmalen Flügel, welcher aus einer zusammenhängenden Reihe zarter Cilien, ähnlich einer Franze, zu bestehen scheint. Die Ausdehnung der Spicula ohne die Cilien beträgt 0.06 mm. Die ganzen Spicula sind 0.8 mm. lang und an der Basis 0.021 mm. dick.¹

This description, one observes, is very much like that of Diesing's in regard to the head, the tail of the female, and, to a great extent, the bursa of the male. But Diesing's two important generic points, the one spicule and the slimness of the anterior part of the body, are shown by Magalhães to be invalid in the one case and of no generic importance in the other. Magalhães added a short historical sketch in which one learns that Lutz used the name *Sclerostoma pingicola* in preference to *Stephanurus dentatus* because of possible complications with *Strongylus dentatus* Rudolphi. The references to the articles in question were incorrectly given, and of the two but one could be found and verified.

Magalhães concluded his article with the statement that according to his opinion the correct name of the parasite is *Strongylus (Sclerostomum) pingicola*.

¹ The Nematodes which I had before me were cylindrical in form; in two of them, one male and one female, the body tapered toward the head; the two others, one of each sex, were, on the other hand, more slender toward the tail end. The mouth is circular; it is followed by a cavity, the circumference of which is provided with six small teeth arranged in pairs. The mouth opening lies a little eccentric of the longitudinal axis of the body of the Nematode, as the head end is bent a little.

The tail of the female is blunt, but ends in a median beak-formed point; one finds on each side a large swelling of a blistered appearance. The tail of the male is not exactly straight; its end is slightly bent. The apparently strongly developed bursa is multilobed; it possesses 5 to 6 symmetrically arranged lobes. Two of the rays of the bursa are triple, two others double, the others single. Complete examination of it demands entire unfolding of the bursa—something I have not been able to accomplish. As I did not wish to sacrifice the complete specimens which I possessed, I had to use the fragments which I received for the examination of the details.

It is very easy to determine the existence of two similar and uniformly developed spicules. These organs are very slightly bent, almost straight; each is surrounded by a skin-like hyaline capsule. The spicules show throughout their whole length, with the exception of their slightly swollen spindleform end and their surface on the side of their slight curve, a narrow wing, which appears to consist of a connected row of delicate cilia like a fringe. The width of the spicules without the cilia is 0.06 mm. The entire spicules are 0.8 mm. long and at the base 0.021 mm. thick.

Ward (1895, p. 308) did not definitely state that he had examined the worm. After a short diagnosis and review he added that so far as known the only effect of the parasites on the animals was to render the livers unfit for use, but that this represented a considerable annual loss to the hog raiser.

Railliet (1896, p. 160) states that the genus *Stephanurus* no longer exists, and that the one species formerly placed there is *Sclerostoma pinguicola*.

NOMENCLATURE.

It seems a little strange that authors have had such difficulty in determining the correct name to use in connection with this worm, since the case of synonymy here to be ruled on is a very common one, simply involving the principles of the law of priority and of the rule of homonyms.

If one accepts the genus *Sclerostoma* as valid, a point upon which practically all helminthologists are agreed, and accepts Diesing's *Stephanurus dentatus* as a sclerostome—a point which can not well be doubted unless a reexamination of Diesing's original specimens proves it otherwise—it is perfectly clear that the term *Stephanurus* must fall as generic term. The name *Sclerostoma* must be adopted unless it be shown from literature that some other name has prior rights.

As for the specific name, the combination of Diesing's *dentatus* with *Sclerostoma* is invalid, since there is already a binomial *Sclerostoma dentatum* (Rudolphi, 1803). Thus Diesing's *dentatus* must be suppressed, and as the next available specific name is Verrill's *pinguicola*, *Sclerostoma pinguicola* must be accepted.

Magalhães's proposition to call the worm "*Strongylus* (*Sclerostoma*) *pinguicola*" implies the acceptance of *Sclerostoma* only as a subgenus, and will, of course, not be accepted by those who not only admit that *Sclerostoma* and *Strongylus* are distinct genera, but place them in separate subfamilies.

In considering Diesing's *Stephanurus dentatus* as identical with Verrill's *Sclerostoma pinguicola* the fact should not entirely be lost sight of that this view is based not upon an actual comparison of type specimens, but upon a comparison of descriptions and of hosts, together with the assumption of a double error of interpretation by both Diesing and Molin, even when these two authors examined the same material. This view is, however, generally accepted to-day.

MATERIAL FOR INVESTIGATION AND METHODS.

The material first at my disposal was provided by the Zoological Laboratory of the Bureau of Animal Industry. Later fresh material was kindly furnished by Dr. Devoe, chief inspector of the Bureau at Chicago. More than a dozen fresh kidneys from hogs with their sur-

rounding fat were examined and proved so rich in specimens that the material at times was more than sufficient for study.

Throughout the leaf lard were found small knots or cysts (fig. 30). Upon cutting into these swellings a worm would begin to protrude and slight pressure on the side of the cyst caused the contents to be entirely evacuated. A small pair of scissors and forceps serve as the best instruments for this work, although the latter must be used with care.

A large number of the females were moistened and teased apart in dishes with covers (in this instance Petri dishes were used) and set aside for development. Many of the worms, both male and female, were studied in a fresh condition. This was accomplished by placing a parasite on a glass slide, covering it with a glass cover sufficiently large to extend over the whole animal and filling the space between the two sheets of glass, caused by the thickness of the round worm, with normal salt solution. In this condition the whole worm could be studied to advantage. For certain parts, such as the mouth cavity or bursa, the same process is recommended. The great majority of the worms were preserved, however, by killing them in an aqueous saturated solution of corrosive sublimate, heated to a temperature of 50° C., and then by placing them in 70 per cent alcohol. The killing process must be performed between two pieces of glass, where the worm may be rolled back and forth and thus prevented from either curling up or shrinking. This is rather tedious, as the movement must be kept up for some time, with frequent additions of hot corrosive sublimate.

When a preserved specimen was to be studied, it was placed between two glass slides, between which was allowed to run, by means of a pipette, some 5 per cent caustic soda. This liquid, in about an hour, so clears up the tissues that a great part of the structure can be readily discerned. For dissection, a fresh specimen may be placed in a flat dish of water or normal salt.

For further verification of the anatomical structure, microtome sections of the parasites were made.

EXTERNAL ANATOMY.

The worms appear quite dark against the fat around the kidneys. This is due mostly to the dark intestine which traverses nearly the whole length of the parasite and shows distinctly through the pale, yellow, transparent cuticle (fig. 31). This darkness is relieved and yet intensified by the very whiteness of the cephalic glands and generative organs. In addition, each side of the worm, from mouth to caudal extremity, is traversed by a red band, the lateral line. This coloring is quite destroyed upon the preservation of the animal; the cephalic glands and generative organs remain as they are, white; the lateral line and cuticle turn white and the opacity of the latter pre-

vents the intestine, to a great extent, from being seen. The males can be quite readily distinguished from the females by their smaller size alone; otherwise it is rather difficult without a keen examination or a good lens, as the bursa of the male is very inconspicuous, proportionately much smaller than the bursa of most members of this family, and the frequent protrusion of the spicules may possibly be mistaken by one not familiar with the species for the sharp-pointed tail of the female. The tail averages 0.384 mm. in length. Moreover, the small cuticular wings on each side of the female, just anterior to the tail,

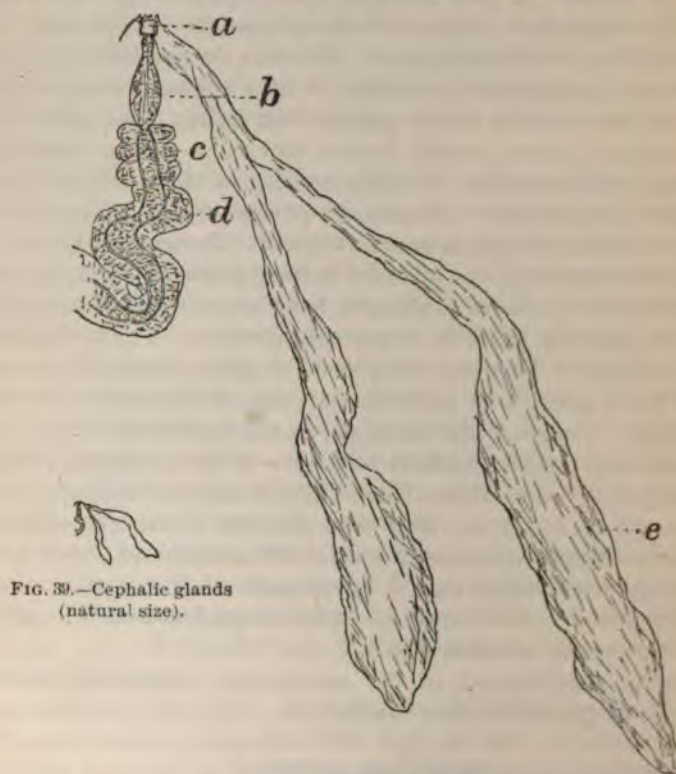


FIG. 39.—Cephalic glands (natural size).

FIG. 40.—Cephalic glands (enlarged). *a*, buccal cavity; *b*, esophagus; *c*, *d*, stomach intestine; *e*, cephalic gland.

look sufficiently like the divisions into which the bursa is separated to make a careful examination necessary. In addition, both tails curl slightly, which prevents any marked distinction being made through that means. Covering the entire body is the light yellowish cuticle, which is so transparent that most of the organs can be readily seen beneath. It is only about 0.005 mm. thick throughout the greater length of the body, but toward the ends, in the approach to the mouth and over the bursa, it increases to about three times that thickness. It is traversed by circular rings, appearing at first glance, at equal

distances from each other. Upon closer examination, however, one observes that the rings are narrower in the middle than at the extremities, the width in the caudal region in several males measuring 0.009 mm. while the width at the middle of the animal measure 0.003 mm. The same relations hold in the females examined.

The buccal end of the two sexes is alike. The mouth is terminal and turned a little toward the ventral surface as the worm at that extremity seems bent slightly that way (fig. 33). It is circular (fig. 34) and measures 0.176 mm. in diameter. Around the buccal cavity are 35 to 40 very fine thread or cilia-like structures measuring 0.032 mm. in length. Outside of this delicate fringe (fig. 37) rise six papillae (figs. 37 and 34). Two, which lie opposite each other, median ventral and dorsal, are especially prominent, while the four other projections are similar in size and appearance and situated submedian. Of the other external openings, that of the cephalic glands (fig. 33) is on the ventral surface near the anterior end of the esophagus; the anus is at the caudal extremity in the male and 0.64 mm. from the caudal extremity on the ventral surface in the female; the vulva is a distance of 0.992 mm. (just about 1 mm.) farther forward than the anal opening (fig. 31). It is a noteworthy fact that Diesing (1839) placed the vulva "at the commencement of the second half of the body;" while Molin (1861), who reexamined Diesing's specimens, stated that it opened in front of the last third of the body.

The caudal extremity of the male forms a blunt end with terminal opening around which is a bursa (fig. 35). The terminal opening leads into the cloaca, into which open the alimentary tract, the genital tract, and the spicules (fig. 42). The bursa is symmetrical and has six lobes. Four of them form the angles of the rectangle, which may be seen by spreading the bursa out flat (fig. 38); the two remaining are on the dorsal surface. Starting from the median dorsal aspect, 6 rays may be found, 3 on either side; lateral of these is a single ray, beyond which, in each of the two dorsal corners, are 3 rays. Of the ventral corners each presents 2 rays, making 9 rays in all on each side. The rays of four groups in the four corners are united throughout the greater part of their length. There are two spicules, equal in length, which pass down dorsally of the alimentary tract into the cloaca (fig. 35). They are long and slender and have on the whole length of one side a structure fringe-like in appearance, making the spicules about double the width which they would otherwise have (figs. 35 and 36). Their length is about 0.8 mm. and their width, without the ciliate structure, is 0.028 mm. Muscles are attached to the upper ends of the spicules and by means of the contraction of these the spicules, when extruded, may be drawn within the body. It may be remembered that Diesing (1839) stated that only one spicule was present; Molin (1861) reexamined Diesing's specimens and also mentioned one spicule.

INTERNAL ANATOMY.

ALIMENTARY TRACT.

The alimentary tract of *Sclerosloma pinguicola* is a greatly convoluted tube. It passes from the mouth at the extreme anterior end of the parasite to the anus, the extreme posterior end in the male and 0.64 mm. forward on the ventral surface from the extreme posterior end in the female. This tube may be divided into the buccal cavity, the esophagus, the stomach intestine, and the rectum. The circular mouth, which has already been described, opens into the buccal cavity, a sac 0.176 mm. in depth, 0.208 mm. in width, and with walls measuring 0.036 mm. in thickness. The lining is a continuation of the external covering of the body. The base of the cavity seems to be drawn into a narrow neck (fig. 32) whose circumference is supported by ten enlargements (fig. 37), which can be seen either from the side

or by looking directly down through the oral opening, as in the figure above mentioned.

The constricted portion of the buccal cavity leads into the esophagus. The latter is nearly ten times the length of the first-mentioned division, or 1.52 mm. In width it varies from 0.112 mm. in the anterior end to 0.448 mm. near the posterior end. The smallest diameter of the esophagus is from 0.16 to 0.32 mm. from the anterior end, thus making the structure Indian-club shape (figs. 40 and 32). Around this smallest portion the nerve ring is to be found. The esophagus, seen in transection (fig.



FIG. 41.—Transection through esophagus. a, cuticle of worm; b, subcutaneous layer; c, outer circular layer of wall of esophagus; d, middle layer of wall of esophagus; e, inner layer of wall of esophagus; f, lumen of esophagus; g, gland-like structures; h, cephalic gland.

41) shows a tube centrally placed in the body. It is formed of converging fibers whose outer edge is covered by a thin cuticular layer and whose inner edge is lined with a cuticle. The outer edge, like the outer coat of the worm, is circular, whereas the inner edge surrounds a lumen with three sides and three angles, forming a triangle whose sides are slightly concave from without. Its appearance is that of a three-pointed star—if such a term may be used—and one of the star projections always points toward the ventral surface of the parasite. Between the three projections, lying in the long radially arranged fibers are three glandular-looking structures, which are found throughout almost the entire length of the esophagus. They are oval-shaped bodies; they stain well with hæmatoxylin and show distinctly under acid-carminé stain. The chitinous lining of the lumen does not appear to be evenly distributed; as shown

in the drawing (fig. 41), it is a very thin layer at the center of the sides of the triangle and gradually grows thicker toward the points. Just before reaching the latter, the outer edge suddenly dips in toward the lumen and out again, thus making, apparently, a projection on either side of the outer angles.

The lower end of the esophagus grows gradually smaller and sinks into the anterior end of the stomach intestine for a distance of about 0.16 mm. Although so closely connected, the two parts, the esophagus and the intestine, remain distinct (fig. 40). The first part of the intestine for a distance of about 0.64 mm. is divided externally into three similar portions, separated by constrictions (fig. 40). They form the only part of the intestine which can be said to be centrally and symmetrically placed with regard to the outer circumference of the worm. The rest of it is so convoluted and at times pushed aside by the genital organs that it is seldom found, in a transection, centrally placed, nor is it often circular. The length of the tube adds to this condition, for it measures about five times the length of the worm itself. The intestinal wall has, as its most prominent part, a layer of large cells whose large nuclei lie near the outer edge (fig. 42). The number and shape of the cells can hardly be stated without further study, as they are very poorly—indeed, scarcely at all—differentiated in the adult parasites studied by the writer. A thin cuticular layer covers the outer surface of the digestive tube, and another somewhat thicker layer the inner surface, next the lumen. Its lower end straightens out between the genital tract anteriorly and the spicules posteriorly (fig. 42) to pass down to the cloaca. The rectum has a cuticular lining in the female; in the male it is replaced by the cloaca.

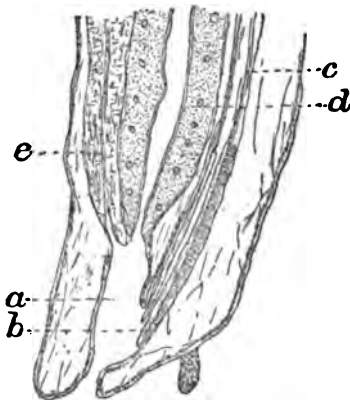


FIG. 42.—Sagittal section through caudal region of male. *a*, cloaca; *b*, spicules; *c*, contractors of spicule; *d*, intestine; *e*, ductus ejaculatorius.

GENERATIVE ORGANS.

The genital organs of nematodes in general are, on the whole, somewhat similar. Yet the differences that are present are of importance, from a classificatory standpoint, and must, therefore, be noted.

Male genital system.—The male genital system of this sclerostome appears, through the transparent cuticle of the parasite, like fine white threads twisting over and around the intestine and enlarging in one part near the posterior end, looking like a white mass. The genital tubes begin as two separate ducts, the testicles, in the anterior part of the body. They are long, white, thread-like tubes, each

leading into a vas deferens, a similar looking duct, from which, however, they can be distinguished when the genital system is separated from the worm and spread out in water. These two parts, one testicle and one vas deferens, together measure 26 mm. in length, and, on an average, about 0.512 mm. in width. After numerous convolutions the two vasa deferentia approach each other near the posterior end of the worm on the ventral side and are then enveloped together—yet remaining as two distinct tubes—in a connective tissue covering and widened to form the vesiculæ seminales. This is the enlarged

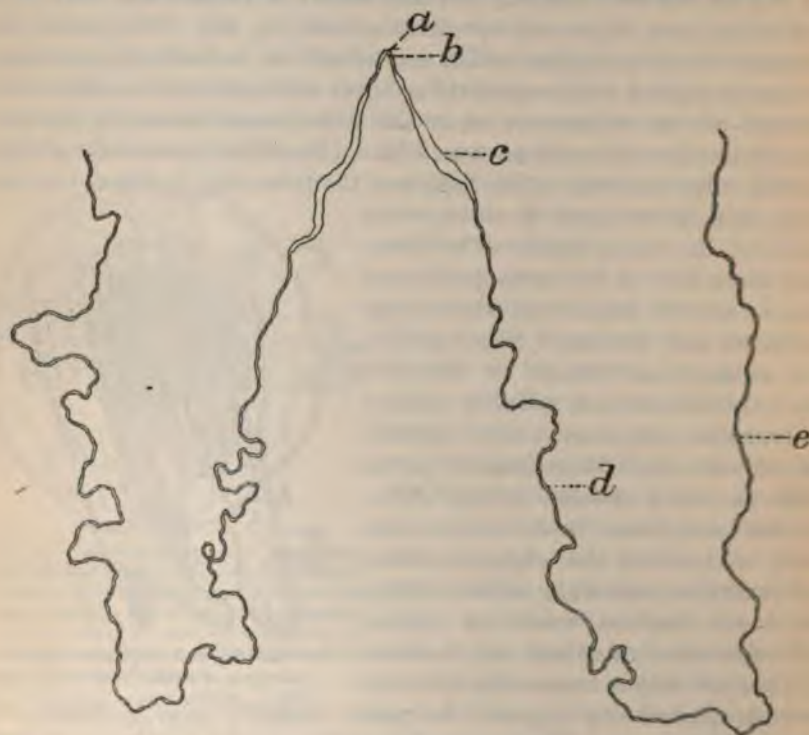


FIG. 43.—Female genital system (natural size). *a*, vulva; *b*, vagina; *c*, uterus; *d*, oviduct; *e*, ovary.

white mass mentioned above. It measures 1.6 mm. in length and 0.8 mm. in width. This storehouse for the spermatozoa then leads down into the ductus ejaculatorius which opens into the cloaca (fig. 42) just in front of the intestine. The copulatory organs—the bursa and spicules—have already been described. The spermatozoa are found, in the adult male, throughout the length of the tubes from the testicles to the external opening. They are club-shaped cells, and measure 0.08 mm. in length and 0.024 mm. in width.

Female genital system.—The appearance of the female genital system, viewed through the cuticle, is very much like that of the cor-

responding system in the male. When spread out (fig. 43) the whole system is seen to be composed of two long slender tubes, joined at the vulva or point of attachment to the body wall. Each tube measures 280 mm. in length. If one observes that the 560 mm. of tubing are contained in a worm one-fifteenth of that distance in length, the fact that the genital organs in the female are also coiled over and around the intestine many times may be well emphasized. Each tube, at its apical end, begins as an ovary (fig. 43 *e*) and passes, imperceptibly to the naked eye, into the oviducts. These enlarge to form the uteri (fig. 43 *c*); from this point of enlargement to the external opening is a distance of 27 mm. The walls of the uteri are thickened, although even here there is only one layer of cells. The posterior end, the vagina (fig. 44), is lined with the cuticle which has extended in from the exterior. The vagina is double; the two horns, uniting at the vulva, measure 2 mm. in length. Eggs were found in the oviduct, the uterus (fig. 44), the vagina, and floating in the substance in which the worms lived. In the uterus they measure 0.10 by 0.056 mm.

DEVELOPMENT SO FAR
AS OBTAINED.

The eggs seen in the adult female are often found in the various early stages of segmentation. For this reason they should be watched

very closely from the beginning. A dish may be prepared according to the directions already given on p. 627. The females used must be in a fresh condition from the hog, though not necessarily alive. Summer heat, or a temperature of about 74° F. (23.3° C.), is the best. A somewhat lower temperature would probably be as satisfactory if time were not a factor, for the eggs might develop as well, though more slowly. A higher temperature might develop them faster, but there would be greater danger of their drying out. An egg measures 0.10 by 0.056 mm. and passes through the different early stages found in related forms. After fertilization and formation of a shell around the egg, segmentation begins. There is first a transverse division. This is followed by the different stages of segmentation as they then develop. The divisions at first seem to be equal, but later, in the sixteen and thirty-two division stages, they appear to be larger at one end than at the other. Upon reaching the mulberry stage the mass retracts from the shell, and, because of its growth, bends on itself. The rhabditiform embryo then begins to develop, the head end first. Gradu-

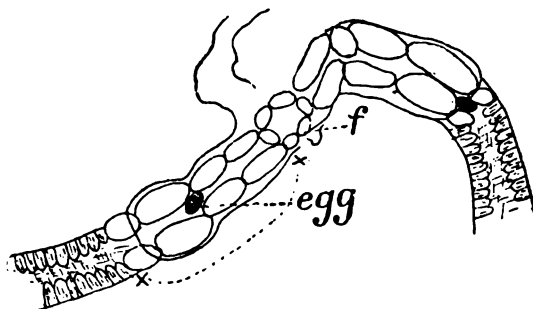


FIG. 44.—Vulva and bicornate vagina. *f*, union of the two horns of the vagina at the vulva; *x*.....*x*, distance of 1 mm.

ally the cells and outline of the cell contents change until nearly the whole mulberry appearance has given way to the clear outline of the embryo still incased in the same sized wall as at first (fig. 45 *a, b*). On the fourth day after the eggs were placed in the dish, as above described, an examination of the contents of the dish revealed the free rhabditiform embryos (fig. 45 *c*). They measured 0.42 mm. in length and 0.0245 mm. in breadth. In the lower part of the esophagus is the three-pronged armature which is characteristic for this stage.

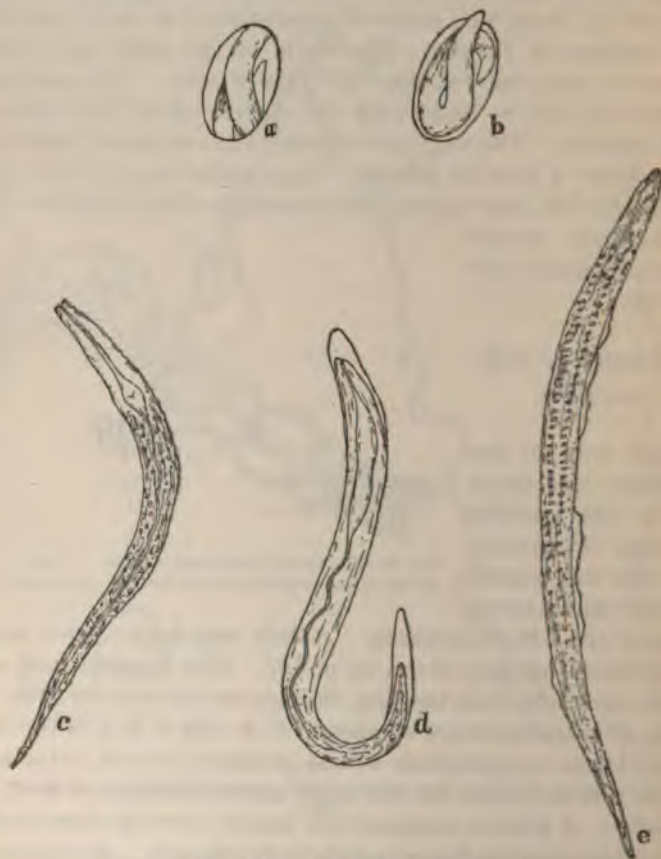


FIG. 45.—Embryos of *Sclerostoma pinguiola*.

Within two days the second stage appears (fig. 45 *e*). Figure 45 *d* shows the transition stage between the two forms. As shown here, before changing its structure, losing its rhabditiform character, and casting its skin, the parasite gradually loosens itself from its outer skin. For some hours it may be seen to contract and then stretch itself out again to the full length allowed by the skin to be shortly cast off. The motion is suggestive of a worm drawing back and

forth in a tube whose closed ends are smaller than the middle of the tube.

Just how the eggs leave the kidney fat or infect fresh hogs has not been demonstrated, but it does not seem unreasonable to suppose that they eventually find their way out with the urine. Indeed, as stated above (p. 623), Dean reports eggs found in the urine. From analogy one is led to believe that no intermediate host is required, but that in all probability the embryos develop for a short time in water, casting several skins, and that they eventually gain access to the hogs either through contaminated drinking water or food.

PREVENTION AND TREATMENT NOT PRACTICABLE.

Because of the hog's habits, it is difficult to see any practical measures which can be adopted to prevent infection. Feeding from troughs and supplying plenty of pure drinking water will decrease but not exclude the disease. Leuckart's advice to the Germans, "Swine should be kept in a less swine-like manner," holds good in all countries and in connection with all diseases. It is equally impossible to suggest practical methods of treatment. This is all the more true because it seems probable that a number of distinct complaints are popularly grouped together by the farmer as kidney worm disease.

ABATTOIR INSPECTION.

Kidney worms are found both by the killing-floor inspectors and by the trichina inspectors. The former have no difficulty in discovering them with the naked eye, while now and then the microscopist finds an entire kidney worm or part of one—usually the esophagus—in examining for trichinae.

Since it is unquestionably true that these parasites are not transmissible to man, either by means of the eggs or by the adult, and since, in addition, the ordinary methods of cooking or curing in vogue in this country would kill the worms even if they were able to develop in man, there is no reason apparent for condemning the carcass of a hog simply because a few specimens of *Sclerostoma pingicola* have been found in it. The infected portions should, however, be cut out and tanked, both from the practical standpoint of the butcher, to render the pork more appetizing, and from the standpoint of the inspector, to prevent so far as possible a further spreading of the disease. If cases of infection which are so extensive as to alter materially the condition of the carcass are met with, they will of course be rejected both by inspectors and by packers.

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THE NATURE, CAUSE, AND ECONOMIC IMPORTANCE OF OVINE CASEOUS LYMPH-ADENITIS.

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AND

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INTRODUCTION.

During the years 1897 and 1898 a number of specimens of degenerated lymph glands, taken from sheep at the registered abattoirs by inspectors of this Bureau, were forwarded to the Washington office with a request for detailed information regarding the lesions. The first specimen came in June, 1897, from Dr. O. B. Hess, stationed at Los Angeles, Cal., who wrote as follows:

I find a condition in sheep, in which the prescapular, the external inguinal, the mediastinal, and the tracheal glands, are enlarged in some instances to four times their normal size, the structures in question containing a caseous material. Occasionally the lung tissue is also involved, but without any inflammation. The affected sheep are in good condition and may even be fat. Thus far I have never observed these lesions in lambs, but only in sheep from two to three years old.

It was stated further that this condition was observed only in sheep from southern California, while animals shipped to Los Angeles from Arizona were not affected. As the specimens thus sent had been shipped a long distance in midsummer, they could not be studied bacteriologically. Later similar specimens were forwarded by other inspectors, notably by those stationed in Chicago, Omaha, and Kansas City. The post-mortem notes accompanying the material seemed to indicate that the animals from which the glands had been taken were usually in good condition otherwise, and that in the majority of cases they "dressed out" well and the carcasses were passed as suitable for food. Only in the case of older animals, especially old ewes, with extensive lesions, did there appear a marked degree of emaciation. The increased number of specimens submitted for examination indicated that the economic importance of the disease in question demanded a more than casual study of the subject, and led to an investigation relative to the nature, cause, and prevalence of the disease by the authors of the present paper.

The lesions were determined without difficulty as identical with those observed in sheep by Preisz and Guinard (30)¹ in 1891. They inoculated guinea pigs and rabbits with fresh material from an affected sheep, and observed as a result a series of pathological lesions which bore a close resemblance to those of tuberculosis; but, instead of Koch's *Bacillus tuberculosis*, they found a thin and very short bacillus with rounded ends. Owing to the character of the alterations it produced they named it *Bacillus pseudo-tuberculosis*. Since then other authors have observed the same bacillus in similar lesions, and their descriptions of its morphology and cultural characteristics have been at variance only in unimportant details.

The bacillus causing the lesions under discussion in the sheep of this country is in most respects identical with the one first observed by Preisz in 1891, and fully described by the same author in 1894 (31).

Name of disease.—Under the name of "pseudo-tuberculosis" a number of diseases and pathological alterations have been described (see pages 664 to 666), the name in every instance being based upon the resemblance of the lesions to those of tuberculosis. On the other hand, the bacillus of Preisz has been obtained from a number of greatly varying pathological conditions in several species of the domesticated animals; and as the disease in sheep, which we are considering in this paper, is accompanied by characteristic pathological alterations of the lymphatic glands we deem it expedient not to use the term pseudo-tuberculosis, but propose the new name "caseous lymphadenitis."

HISTORY AND GEOGRAPHICAL DISTRIBUTION.

Up to the present time caseous lymphadenitis has not been recognized generally as one of the more common infectious diseases of sheep. Most of the modern text-books on veterinary pathology pay little or no attention to it (Kitt, Schneidemühl, Friedberger and Fröhner), and it is, therefore, not surprising that the practitioner in general and the meat inspector in particular is unfamiliar with the true nature of this easily recognized and very characteristic disease. With the exception of Preisz and Guinard's one case, recorded in 1891, no publication on this disease in sheep appeared until 1894, when Preisz took up the question again and devoted himself especially to the comparative pathology and differential diagnosis of the various lesions which at that time were classified under the heading of pseudo-tuberculosis. He also made a thorough investigation of the morphology, cultural characteristics, and pathogenesis of the bacillus, which has been named for him; for this purpose he used the same material (the kidney of a sheep killed in 1891), upon which he had previously written.

From that time and until June, 1897, no more cases were reported, although there can be little doubt that the disease must have been

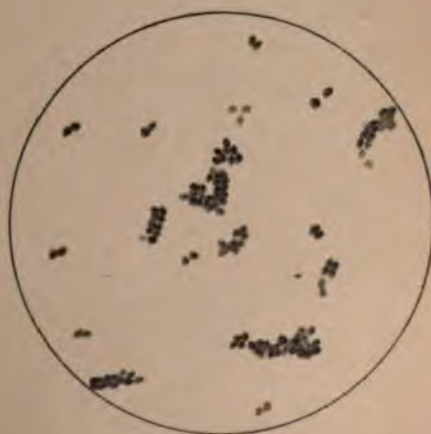
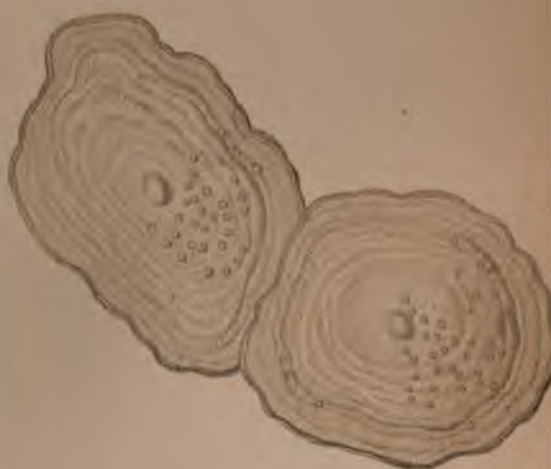
¹ References of this kind are to the bibliography appended to this article.

prevalent to a greater or less extent in some of the places where it has since been observed. At the above-mentioned period, Turski (35) published an article on an epizootic of pseudo-tuberculosis in sheep from West Prussia, which came to his notice while he was meat inspector at the abattoir at Danzig. One hundred and fifty breeding ewes from eight to twelve years old, all originating on the same estate, were brought to the stock yards and sold to a local butcher. Many of them were in very poor condition, and on ante-mortem inspection a number of them showed nodules, or abscesses, the size of a child's fist in the inguinal and prescapular regions. On post-mortem examination the bronchial and mediastinal glands of the affected animals were found to be much enlarged and showed on section numerous foci containing greenish yellow caseous or grumous material. Some of the glands had the appearance of degenerated echinococcus cysts. The same condition was observed in the portal, the inguinal, and the precrural glands, some of which were entirely transformed into a homogeneous mass arranged in concentric layers, like the scales of an onion, and surrounded by a thick, fibrous sac. In no case were the mesenteric glands affected. The disease seemed to be confined to the lymphatic glands, and not even in those cases, where the bronchial, mediastinal, or portal glands were involved, could any trace of the lesions be found in either the lungs or the liver. A total of 44 animals out of 150, or nearly 30 per cent, were found to be more or less affected. The sheep were all pure-bred Merinos of the Electoral strain and originated on an old estate (Rittergute) where inbreeding had been practiced since 1825. The cases were diagnosed as pseudo-tuberculosis, and the bacillus of Preisz was found in all the lesions (Ostertag (27)). A number of similar epizootics have been observed by the chief inspector of the public slaughterhouses in Gotha, Saxony (Ostertag).

In 1899 Cherry and Bull (4), of Melbourne, Australia, undertook to investigate a disease in sheep which, on post-mortem examination, were found to be affected with enlarged caseous lymph glands. They state that some of the flocks brought to the public abattoirs for slaughter are affected to the extent of from 15 to 70 per cent. The lesions observed are in every respect similar to those described above, but the animals most generally found affected are the wethers, while the lambs are practically exempt. The prescapular and superficial inguinal glands are most frequently affected, followed by the serotal and the deep glands of the pelvis and the chest. In one or two cases out of many thousands examined they found similar lesions in the kidneys, but never in the mesenteric glands or liver. The authors call

DESCRIPTION OF PLATE XXV.

1. Isolated colonies upon inclined agar-agar 12 days old, natural size.
2. Ditto, magnified about five diameters.
3. Agar culture 48 hours old.



Haines, del.

AGAR CULTURE OF THE BACILLUS OF CASEOUS LYMPH-ADENITIS.

the disease "caseous lymphatic glands in sheep, or pseudo-tuberculosis," and mention the bacillus of Preisz as the probable cause.

In the Argentine Republic a disease of sheep similar in most respects to that already mentioned has been described in a very able paper by Sivori (32) under the name of caseous broncho-pneumonia in sheep. It is produced by the same bacillus described by Preisz, but it appears to have a greater affinity for the thoracic viscera. In this respect the conditions, as observed in the United States, seem to stand midway between those observed, on the one hand, in Germany and Australia, and, on the other, in the Argentine Republic. Sivori also finds that lambs are rarely affected, but that 10 per cent of the older sheep killed at the abattoirs in Buenos Ayres show the typical lesions. These consist in enlarged caseous bronchial and mediastinal glands, with or without accompanying caseous broncho-pneumonia and adhesive pleurisy. The histological changes correspond to those observed here and in other countries, with the exception that calcification of the caseous material is commonly noted. He further states that the mesenteric glands are often affected and that the liver is frequently studded with miliary or submiliary nodules, besides larger abscesses. The kidneys, as a rule, show one or more nodules, which, when located on the surface, may become very large. On the whole, the Argentine sheep seem to be more susceptible to the disease, as the lesions exhibited by them are more extensive, although the bacillus in question does not seem to be more virulent than the one investigated by us.

In the United States the disease seems, at the present time, to be rather common in certain Western districts. It was first reported from southern California in 1897—that is, soon after meat inspection was established there. It is not possible to determine how long it had existed there previous to that time, as the owners of flocks, as a rule, are ignorant of its presence; but judging from its prevalence in Europe, South America, and Australia, as well as to its wide spread in this country, it is not unreasonable to assume that the infection, which no doubt is of miasmatic nature, is of no recent origin. (See page 660.)

SYMPTOMS.

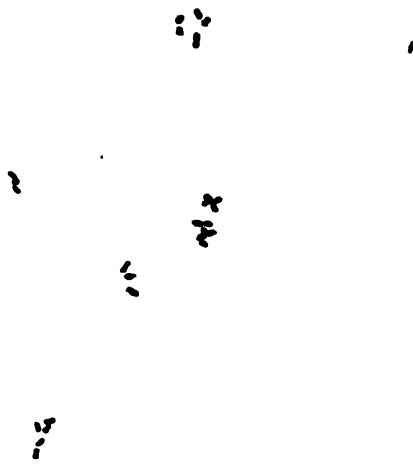
In the majority of cases no symptoms of any importance are observed in the affected animals during life. The course of the disease is chronic, and the pathological changes develop so slowly as to cause no general or local interference with the well-being of the affected animals. This pertains especially to lambs and sheep which are bred and raised for mutton, and which are marketed before they are 2 years old. Only in breeding ewes and wethers does the disease advance to a degree which makes it clinically recognizable without the aid of manipulation.

When an inspector on the killing floor observes that a number of

sheep out of a certain flock exhibit enlarged caseous lymph glands, and then proceeds to the yards and submits the flock in question to a thorough examination, he will find that a certain percentage of the young animals shows enlargement of one or more of the superficial glands, the precrural and the prescapular glands being most frequently affected. This enlargement can be noticed only by means of careful manipulation, for the animals thus affected seem in every other respect to be in perfect health. In the older animals—the wethers and breeding ewes—the same glands may be enlarged to a considerable degree reaching the size of a hen's egg or even larger, and some of these animals may show a certain degree of unthriftiness or even emaciation. The older ewes especially seem to suffer the most, which is probably due to the fact that the wethers are generally disposed of before they are 3 years old, while a good breeding ewe is frequently retained for seven or eight years. In such old animals the superficial lymphatic glands may be enlarged to such a degree as to interfere with locomotion, while the deeper-seated glands and those in the body cavities are similarly affected. This condition, in connection with the loss of vitality caused by continued breeding and rearing of the offspring, reduces the original power of resistance of the system, and causes a dissemination of the disease by metastasis to the principal organs of the body. In such cases the disease may assume the appearance of chronic broncho-pneumonia or pleurisy, with symptoms of occasional cough, slight dyspnea, and increasing emaciation and anemia. The course of the disease is, however, exceedingly slow, and no fatal case has been observed by us nor have we seen any recorded. It is, therefore, the rule that owners of affected flocks are totally ignorant of the presence of the disease, a fact which has made it very difficult to obtain reliable information regarding its prevalence. We have been obliged, therefore, to rely almost entirely on the statistics obtained from the slaughterhouses; and, as a majority of inspectors had classified the lesions either as tuberculosis or pyemia or abscesses, it became necessary to ascertain just what conditions were covered by these terms. In response to inquiries it was found that the majority of cases condemned under these headings were in reality nothing but caseous lymph-adenitis. Several thousand cases are annually observed in the slaughterhouses of the United States, but only a fraction of these are advanced to a degree that would warrant the total condemnation of the carcass. All the inspectors with whom we have corre-

DESCRIPTION OF PLATE XXVI.

1. Film preparation of pus from a degenerated prescapular gland of a sheep with natural infection. Stained by Gram's method, counterstained with eosin. 1,000 diameters. Zeiss No. 6 compensating ocular, 2 mm. oil imm.
2. Film preparation of pus from a caseous lymphatic gland of a rabbit. Stained with alum carmine followed by Gram's method. Magnified 1,000 diameters. No. 6 ocular, 2 mm. oil imm.



Heal, del

THE BACILLUS OF OASEOUS LYMPH-ADENITIS.

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sponded regarding this subject agree that lambs are very rarely affected, and that the progress of the pathological changes in the majority of cases is coordinate with the age of the animal.

PATHOLOGICAL ALTERATIONS.

As already indicated, the principal lesions are confined to the lymphatic glands. In many cases only a single gland is affected. The relative frequency with which the various ganglia become the seat of the lesions may be given as follows: Prescapular, precrucial, superficial inguinal, bronchial, mediastinal, sublumbar, deep inguinal, and scrotal. In one sheep have we seen a suprasternal and in another one of the mesenteric glands affected. In the former case the gland was located beneath the pleura and the constant pressure exerted by the enlarged gland had caused complete atrophy of the adjacent part of the sternum (Pl. XXVII, fig. 4). Although the bronchial and the mediastinal glands are not infrequently affected, we have failed to obtain any evidence of an invasion of either the retropharyngeal or the submaxillary glands. Sivioli mentions the mesenteric glands among those frequently affected, but in a detailed description of the postmortem lesions of twelve typical cases of caseous bronchopneumonia, caused by the bacillus of Preisz, he fails in every instance to mention the mesenteric glands as a seat of affection.

When first invaded by the bacillus, the adenoid tissue becomes hyperplastic and the gland enlarges to several times its original size. On section the surface is found to be watery, but otherwise the tissue retains its normal appearance. This is followed by the formation of various centers of degeneration which show concentric layers and gradually become confluent. Finally the total volume of the gland is transformed into a homogeneous caseous mass. At the same time the distended capsule increases in thickness and forms a solid sac which keeps the semifluid grumous mass confined within its bounds. In rare instances does the sac rupture, and when close to the surface the contents will be discharged in a manner similar to the discharge of the contents of an ordinary abscess. We have had no occasion to observe the result of rupture of any of the deep glands, but it is to be presumed that when it occurs it will cause pathological alterations similar to those resulting from the experimental inoculation of an excessive dose of virulent material. Under ordinary circumstances the caseous contents become cohesive and sticky and of the consistency of putty. In very old cases the mass becomes dry and mealy, but shows little or no inclination to become calcareous.

Most characteristic is the color of the mass, which is of a greenish yellow tint closely resembling the contents of the intestinal nodules produced by *Esophagostoma columbianum*. In very advanced cases, as, for instance, those of old breeding ewes, the principal internal organs may on post-mortem examination be found to contain lesions

which macroscopically resemble those of tuberculosis. The lungs may be studded with small nodules the size of a pea, and the spleen and liver, in rare instances the kidneys also, may contain one or more foci of the same characteristic lesions, namely, a mass of greenish yellow material, surrounded by a firm fibrous sac. There seems, however, always to be a distinct division between the affected and the healthy tissue, and the total lack of an inflammatory zone is very characteristic. The bronchial and the mediastinal glands may be affected to a considerable extent without any lesions being found in the lungs, but at other times the lungs are extensively affected. The alterations may be either miliary or varying in size from a millet seed to that of a walnut. This condition is, as a rule, accompanied by a chronic pleurisy with extensive adhesions, and also effusions into the pleural cavities.

In the liver the alterations are most frequently in the shape of larger nodules, consisting, like those in the lymphatic glands, of a firm white fibrous sac containing a greenish yellow cheesy mass of varying consistency. Cases have been observed, however, where the entire organ was filled with miliary nodules.

The kidneys are rarely affected, but when it occurs the lesions assume the same characteristic appearance; that is, of a firm-walled abscess protruding on the surface of the organ. As a rule, only one or two such foci are observed in each case.

MICROSCOPICAL EXAMINATION.

Cover-glass preparations made from the caseous contents of a characteristic nodule furnish, as a rule, no clue to the cause of the disease. An amorphous, granulated mass, in which the remains of disintegrated leucocytes may be seen, is the usual picture, and only when the preparations have been made from the periphery of the nodule or by scraping the inside of the capsule does the bacillus appear at all in abundance.

On histological examination of tissue containing miliary or sub-miliary nodules, the latter are seen to consist chiefly of leucocytes and nucleated round cells, the greater part of which are irregular in shape, especially toward the center, where many of them are transformed into a granular, detritus mass. Among the cells, singly or arranged in clumps, are seen the short, plump bacilli, which stain irregularly. The shape varies considerably, from oval or oblong to dumb-bell and club shape (Pl. XXVI, fig. 2). The bacilli are frequently seen within the degenerated leucocytes, the destruction of which is no doubt due to specific chemical products excreted by these microorganisms (Preisz).

The microscopic appearance is somewhat similar in all the lesions, whether located in lymph glands, lungs, liver, kidneys, or spleen. In the lungs the histological picture resembles that of broncho-pneu-

monia. In the liver the lesions originate in the portal capillaries, where the bacilli become lodged and cause a proliferation of the endothelial cells, which, together with the accumulation of leucocytes and red blood corpuscles, cause an obliteration of the vessels. In no case have giant cells been observed. The surrounding hepatic cells become swollen, then granular, and finally they undergo atrophy, leaving open spaces between them. Bacilli are often seen among these degenerated hepatic cells, and no doubt they cause an extension of the process into the adjoining healthy tissue. At this period, however, a reaction takes place. Numerous round cells appear in the periphery of the nodule and gradually undergo a connective tissue metamorphosis, and become organized into an encapsulating membrane.

When a miliary nodule from the liver of an experiment animal which has been destroyed three weeks after inoculation is examined under the microscope, we observe the following picture: A caseous center composed of an amorphous material that does not take any of the ordinary stains. Surrounding the center may be seen numerous leucocytes, more or less degenerated and frequently containing one or more bacilli, while clumps of these organisms are scattered among them. External to this is a dense round-cell infiltration the peripheral zone of which is undergoing connective-tissue metamorphosis and serving as line of demarcation between the atrophied liver cells and the central cell mass. This process then repeats itself centrifugally, causing the appearance of concentric layers, until a sufficiently strong reaction takes place to form a connective-tissue barrier strong enough to encapsulate the central part of the nodule and prevent its further growth. The nodules in the kidneys and lungs present a similar microscopic appearance, excepting that the foci in the lungs are more irregular on account of the catarrhal inflammation that accompanies the reaction of the surrounding tissue. The center contains a dense mass of disintegrated cell structure composed of the desquamated and proliferated epithelial cells, degenerated leucocytes, and round cells. In experiment animals which succumb quickly to an intravenous injection of virulent material, the lung tissue immediately surrounding the nodules is frequently seen to be hepatized.

TECHNIQUE.

In preparing the above-mentioned pathological lesions for microscopic examination, the tissue was in all cases embedded in paraffin. The distribution of the bacilli and the histological characteristics are best brought out by means of Gram's method after the section has been previously stained in alum carmine. Toluidin blue also gives excellent results, while hematoxylin-eosin and carbol-fuchsin counter-stained with methylene blue gave less satisfaction.

BACTERIOLOGY.

Morphology.—The microorganism of caseous lymph-adenitis is a short plump bacillus with rounded ends. In size and shape it varies greatly, according to the conditions under which it is seen. In fact its polymorphism is characteristic. In cover-glass preparations made from an affected lymph gland of a sheep (Pl. XXVI, fig. 1), and stained after Gram, the various forms may be easily observed. Some are ovoid or nearly coccus shaped while others are dumb-bell or club shaped. The latter range in size from 1.3 to 1.6 μ long and 0.4 μ thick. In the early cultures longer forms are observed, rounded at the ends and either straight or slightly curved. These larger forms show swellings at one or both extremities. The swollen part is more refractive to light and stains more deeply than the remaining part. In old agar cultures the short ovoid forms predominate and appear in hanging-drop preparations as diplo-bacilli or unevenly arranged in clumps (Pl. XXV, fig 3).

The bacillus is an aërobe, facultative anaërobe, and stains well by Ziehl's and Loeffler's method, and also by Gram's. It does not form spores nor does it show vacuoles, crystals, or capsule. It is nonmotile and flagellæ have not been observed. It is very susceptible to the effect of acids.

Cultural characteristics.—Cultures are most easily obtained by inoculating slant agar tubes with a portion of caseous material obtained from the periphery of an affected lymph gland. The first cultures grow slowly and sparsely, but when the bacilli accustom themselves to the artificial media a more profuse growth may be obtained in the subsequent series.

The growth produced on slant agar is very characteristic. If a loopful of the above-mentioned material is drawn over the surface there appears in the course of four or five days a limited number of well isolated colonies, showing at first as grayish white points. On the twelfth day they will have attained their full size; that is, 4 to 6 mm. in diameter, appearing as a thick grayish white expansion, more or less rounded, with a shiny wax-like, slightly granular surface marked by wavy concentric rings arranged parallel to the margin. The colonies have crenated borders and a papillated center (Pl. XXV, figs. 1 and 2).

When a pure culture is used for inoculation on slant agar the colonies appear in forty-eight hours, growing very abundantly over

DESCRIPTION OF PLATE XXVII.

1. Inner aspect of the left foreleg of a rabbit inoculated intravenously, showing a chain of pearly white nodules along the course of the lymphatics.
2. Superficial inguinal lymph gland from a sheep with an idiopathic infection.
3. Prescapular lymph gland of a sheep similarly affected.
4. Suprasternal lymph gland of a sheep, causing atrophy of the sternum.



W. H. Dall.

LESSONS OF CASEOUS LYMPH-ADENITIS IN RABBIT AND SHEEP.

1

the whole surface and becoming confluent. All cultures grown on agar are characteristic in being extremely dry and cohesive when touched by the platinum wire. This cohesive property also manifests itself when cover-glass preparations are made and examined under the microscope. The bacilli are then found to be arranged in clumps (Pl. XXV, fig. 3). The pus from affected animals is likewise seen to be cohesive and sometimes even assumes the consistency of glue.

In agar stab cultures, small grayish white globular colonies appear along the entire line of puncture. They do not become confluent but remain separated and assume a fringed exterior. In the course of forty-eight hours a characteristic growth, similar to that which occurs on slant agar, appears on the surface and spreads slowly.

Agar plate cultures are made in preference to gelatine plates, as the growth is extremely slow at room temperature. The best results are obtained by making smear inoculations on the surface of the media after it has become solid in the plates. The colonies are in every respect similar to those on slant agar. When the regular method of plating is adopted deep colonies are observed. They attain a size of one-half millimeter in diameter, are regular in shape, and of a grayish white color.

Glycerine agar is not a very favorable medium; the bacillus grows more slowly and not so abundantly as in agar.

In *peptonized beef bouillon* (1 per cent + to phenolphthalein) a general turbidity occurs in the course of thirty-six hours. Then the bouillon gradually becomes clear, while a granular sediment collects on the bottom of the tube. A scaly grayish white greasy looking pellicle forms on the surface and adheres closely to sides of the tube, but by agitation it is broken up into flakes which settle to the bottom. A new pellicle is slowly formed, but it never becomes as strong as the original one.

The bacillus will grow in both alkaline and acid broth (2 per cent + to phenolphthalein), but an acidity of 2.8 per cent kills the organism. Old bouillon cultures give a pronounced alkaline reaction.

Gelatine at room temperature does not prove a desirable media for the organism. When incubated at 37.5° C. the growth is identical with that in bouillon.

On *blood serum* the bacillus grows more readily than on any other media, although the cultures are not so characteristic as are those on agar. The growth is marked at the end of forty-eight hours by the appearance of small pin-point colonies, which increase slowly until the tenth day, when they have attained a diameter of 1 to 1.5 mm. The border is slightly irregular with a dry, glistening, uneven surface of a color varying from deep yellow to grayish white. The colonies appear to send off lines of growth extending below the surface, and are surrounded by a cloudy zone which reflects to a greater or less degree the color of the colony. This outward radiation becomes more

marked, until finally the contour of the colony is entirely effaced. The property of chromogenesis varies greatly, even under uniform conditions, although serum from cattle produces a more stable coloration than does that of the dog. The water of condensation contains a copious sediment of small granules which give it the tint of the colonies.

On *potato* the growth varies to a great extent. This is probably due to variations in the acidity of the media and may possibly be dependent upon the vitality or sensibility of the inoculated material. On potato with an acidity of from 0.9 to 1.8 per cent + to phenolphthalein a grayish white, slightly moist growth spreads irregularly over the surface. In some cases it is hardly visible to the naked eye, and, as a rule, it reaches its maximum growth at the end of the second week. With an acidity of 2.9 to 3.6 per cent no growth occurs, while the addition of a few drops of a 5 per cent sodium hydroxide solution to the surface will cause the growth to appear.

In *milk* growth takes place without visible change; no whey is formed nor is the milk coagulated.

Fermentation of sugar.—Bouillon containing 1 per cent of dextrose in fermentation tubes becomes cloudy in thirty-six hours, and after forty-eight hours a pellicle is formed on the surface of the broth in the bulb, while a sediment appears at the elbow. Fermentation occurs in the bulb, causing an acid reaction, while the contents in the closed tube remain unchanged (phenolphthalein test). Similar tubes containing 1 per cent of lactose and saccharose show the same form of growth, but differ as to their profuseness. The culture in lactose is not so abundant as in dextrose, while in saccharose it is still less profuse than in lactose. The bacilli have no action upon the molecule of lactose or saccharose. Gas is not produced during growth in any of these sugar-containing media.

Indol and phenol.—Cultures in a peptone solution treated after

DESCRIPTION OF PLATE XXVIII.

Guinea pig inoculated subcutaneously with 0.75 cc. of a four-day-old bouillon culture. Died in fifteen days.

Organs in situ.

- (a) Preauricular lymph gland.
- (b) Submaxillary lymph gland.
- (c) Sublingual lymph gland.
- (d) Retropharyngeal lymph gland.
- (e) Prescapular lymph gland.
- (f) Lungs with caseous foci and areas of hepatization.
- (g) Liver containing small tubercle-like nodules surrounded by apparently healthy tissue.
- (h) Spleen similarly affected.
- (i) Kidney congested with three miliary foci.
- (j) Stomach, normal.
- (k) Intestines, normal.



CASEOUS LYMPH-ADENITIS IN GUINEA PIG.

Edmond M. S. Symonds, Esq. R.S.

1. The first part of the document is a list of names and titles, including the names of the authors and the titles of the works. This list is organized in a table format with two columns: the first column contains the names of the authors, and the second column contains the titles of the works. The names are listed in alphabetical order, and the titles are listed in the order in which they appear in the document.

Kitasatos's method failed to give the indol reaction. When treated according to Weyl-Lewandowski neither the phenol nor indol reaction could be observed.

Temperature requirements.—The temperature at which the organism develops most abundantly is 37° C., although in suitable media growth may occur more slowly in room temperature. Bouillon tubes kept at a temperature of from 16° to 18° C. became fertile, but no growth occurred at a temperature of 43° C.

Thermal death point.—Tubes of bouillon inoculated with one-fourth cubic centimeter of a fresh bouillon culture and exposed in a water bath to a temperature of 65° C. for ten minutes or longer did not develop. A 3-days-old culture exposed to 70° C. for six minutes became sterile. An exposure of sixteen minutes to 60° C. did not prevent development, while eighteen minutes at 60° C. killed the organism.

Effect of desiccation.—Two platinum wire loopsful of a bouillon culture were placed in a sterile tube and put in the incubator over night to dry. When subsequently exposed to the effect of sunlight for five days, the vitality of the organism was still retained. Tubes similarly prepared and exposed for six days or more proved to be sterile.

Effect of low temperature.—Bouillon tubes inoculated with the organism were packed in a freezing mixture twice daily for three days and placed in the ice chest. These showed subsequent growth when incubated at 37° C. Similar tubes kept in the ice chest at a temperature of 6° to 8° C. for a period of several weeks showed subsequent development when incubated at 37° C.

Action of disinfectants.—A 2.5 per cent solution of carbolic acid proved fatal in one minute. A 0.25 per cent solution of formalin killed the organism in six minutes. Limewater did not retard subsequent growth after an exposure of twenty-three hours. A 1-2000 solution of bichloride of mercury caused the death of the bacillus in four minutes.

EXPERIMENTS.¹

EXPERIMENTS ON GUINEA PIGS.

Intravenous inoculations.—When a dose varying in size from three drops to 0.3 cc. is injected into the saphena vein, death occurs in from four to ten days, according to the size of the dose. On the day following the injection the temperature rises to about 104.7° F.; the animal refuses to eat and assumes a crouching position, and the coat becomes ruffled. This continues until death approaches, when the temperature falls below normal.

The pathological alterations found on post-mortem examination are very characteristic and nearly identical in all cases. On opening the

¹ When not otherwise stated there has been used in all inoculation experiments a 4-days-old bouillon culture filtered through sterilized cotton.

animal the lesions observed are those of a general infection. The lungs contain numerous yellow nodules which sometimes coalesce, forming large caseous masses. The smaller foci and the edges of the larger masses are surrounded by an inflammatory zone. In some cases the pleural cavity contains a purulent exudate with fibrous adhesions. The liver is enlarged and congested, and shows a variable number of caseous foci scattered throughout the parenchyma of the organ, ranging in size from that of a clover seed to a bean, and of a yellowish white color. The spleen is enlarged and friable, and studded with numerous caseous foci the size of pin heads. The kidneys are congested and may present several smaller foci, or a single larger nodule. In some cases the sublumbar lymph glands contain similar foci. Cultures made from the above-described lesions give, in all cases, numerous colonies of the specific bacillus, but the blood is always sterile.

Intra-abdominal inoculations.—A dose of from 0.3 to 0.75 cc. injected into the abdomen proves fatal in from eight to fifteen days. At the point of inoculation there forms a small necrotic area generally denuded of hair and surrounded by an inflammatory zone. The corresponding region in the abdominal cavity shows local peritonitis with a caseous center. The lymphatics of the mesentery are enlarged and softened and a number of small whitish foci are sometimes seen in the peritoneum. These foci may become adherent to the visceral peritoneum. The principal lesions appear in the liver and resemble closely those produced by intravenous injection, although this appearance is sometimes obscured by a profuse suppurative peritonitis causing adhesions between the liver and the abdominal wall and stomach. (See Pl. XXIX, fig. 2.) The abdominal cavity shows a varying quantity of turbid fluid, from which the specific organism may be obtained. The spleen is affected in a way similar to that described above, but the kidneys are rarely affected. Occasionally the lungs show caseous centers in several lobes in connection with sero-fibrinous pleurisy. In one instance a small caseous focus, the size of a small grain of wheat, was observed on the tunica vaginalis, and on microscopic examination it was found to contain the specific bacillus. The inguinal and sublumbar lymph glands are sometimes affected, especially those located on the side on which the inoculation was made.

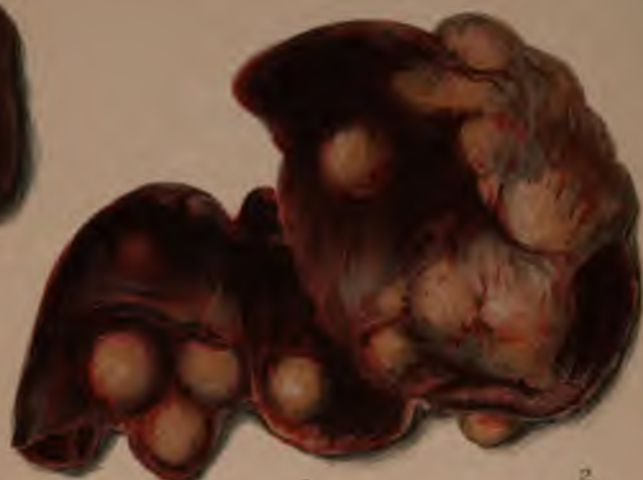
Subcutaneous or intramuscular inoculations.—Guinea pigs when inoculated in the hind leg with 0.25 to 0.75 cc. die in from fifteen to

DESCRIPTION OF PLATE XXIX.

1. Kidney of a rabbit inoculated intravenously with 0.3 cc. of a four-day-old bouillon culture.
2. Liver of a guinea pig inoculated intra-abdominally with 0.75 cc. of a four-day-old bouillon culture.
3. Liver of a rabbit inoculated intravenously with 0.3 cc. of a four-day-old bouillon culture.



1.



2.



3.

Haines, del.

PLATE XXIX. (1899, B.)

LESIONS OF CASEOUS LYMPH-ADENITIS IN LIVER AND KIDNEY OF GUINEA PIG AND RABBIT.

1. The first part of the document is a list of names and dates.

twenty-eight days. Considerable tumefaction appears at the place of inoculation, and on the sixth or seventh day it undergoes either liquefaction or coagulation necrosis. In the first case the skin may rupture and the liquid contents become discharged. Otherwise the swelling remains intact and becomes encapsulated in a dense fibrous membrane. The adjacent lymphatics become enlarged and painful and undergo complete caseous degeneration. The cheesy material contained in these glands is of the characteristic greenish yellow color and contains the specific bacillus.

When very large doses are injected subcutaneously the result may be a general infection with lesions in the liver, spleen, and lungs similar to those resulting from intravenous injection. (See Pl. XXVIII.)

Feeding experiments.—Guinea pigs which had fasted for twenty-four hours were given a small quantity of oats over which had been poured a 4-days-old bouillon culture. A quantity of the same material was added to the drinking water. The animals received no other nourishment until the infected food had been taken. Death followed in from five to eight weeks. On post-mortem examination the lesions appeared to be similar to those resulting from intravenous inoculation except that the lymph glands of the head and throat were usually affected, and owing to the more chronic course of the disease, the foci in the various organs were considerably larger and in the liver reached the size of a hazelnut. In no case, however, were any lesions found in the lungs.

EXPERIMENTS ON RABBITS.

Intra-abdominal inoculations.—A dose of 0.25 to 0.75 cc. causes death in from twenty to thirty-two days. The pathological alterations resemble in most respects those in the guinea pig. In comparing the course of disease in these two species of animals it will be seen that rabbits are more resistant, and in consequence of the more chronic nature of the disease we find the nodules in the affected organs to be larger in size but fewer in number. In rabbits the lesions assume a pearly white color, while in guinea pigs they are of a more yellowish tint. In rabbits the pus is more cohesiv and putty like than is the case in guinea pigs. For illustration, the post-mortem notes of a typical case are given below:

On December 26 rabbit No. 330 received 0.5 cc. of a 4-days-old bouillon culture. The animal remained apparently healthy until the seventh day, when its temperature rose to 102.6° F. This increased gradually until the twentieth day, when it reached 104.3° F. Death occurred on the night of January 18, the temperature having fallen the previous morning to 98.3° F. Prior to death symptoms of listlessness and capricious appetite, followed by anorexia, gradual emaciation, and sluggishness, were observed.

Post-mortem examination showed a localized peritonitis at the point of inoculation.

Heart.—Apparently normal.

Liver.—Left lobe contained a focus the size of a hickory nut and was adherent to the peritoneum. The middle lobe showed two nodules the size of a white bean and composed of disintegrated material of a milk-white color. The right lobe contained four nodules of similar size, appearance, and consistency.

The spleen was slightly enlarged and contained two foci on the surface as large as peas.

Kidneys.—The right kidney had one large nodule one-half of an inch in diameter and situated at the hilum. The left kidney had three smaller foci appearing just under the capsule.

The sublumbar glands were swollen to the size of hazelnuts, irregular on the surface, and containing caseous material.

Intravenous injections of 0.3 and 0.5 cc. of an emulsion made from a caseous lymph gland of a sheep causes death in from sixteen to twenty-five days, while the same amount of bouillon culture proves fatal in from ten to eighteen days. Below will be found the notes from a typical case:

On December 16 rabbit No. 325 received 0.3 cc. of a gland emulsion, prepared by grinding the caseous material from a degenerated lymph gland in a sterile mortar with a normal salt solution. The injection was made into the posterior auricular vein, and death followed on January 10.

Post-mortem examination revealed a small, firm abscess at the point of inoculation, due to the escape during injection of some of the virulent material. Metastatic abscesses and septic arthritis were observed on the carpal and metacarpal joints of both fore legs and of the metatarsal joint of the left hind leg. (See Pl. XXVII, fig. 1.) The lymphatics along the entire length of the left fore leg were nodular and caseous, while on the left hind leg a large abscess filled out the entire space anterior to the tendon of Achilles. Cover-glass preparations made from the pus of these abscesses and stained with Loeffler's solution showed the specific bacillus in pure cultures.

Lungs.—The cephalic lobe of the right lung contained one caseous focus about one-quarter of an inch in diameter, while the principal lobe showed three similar nodules, all attached to the parietal pleura. The left lung contained but two foci, one-eighth of an inch in diameter and located in the ventral lobe.

The liver contained numerous small nodules, as shown in the illustration (Pl. XXIX, fig. 3).

The spleen contained but one nodule, the size of a pea.

The kidneys were both slightly congested, with one focus on the surface of the left organ. (See Pl. XXIX, fig. 1.)

Subcutaneous inoculation.—When rabbits are inoculated by this method, death does not occur until from the thirty-fifth to forty-eighth day, and the animal becomes greatly emaciated before it succumbs. The resulting lesions are similar to those observed in guinea pigs. The point of inoculation is inflamed, swollen, and tense, the tumefaction gradually changing into caseous material surrounded by a fibrous sac.

The lymphatics adjacent to the point of inoculation become involved and foci of varying sizes may be observed in the lungs, liver, spleen, and occasionally in the kidneys. As in the guinea pig, the liver appears to be the favorite seat of the lesions.

Feeding experiments.—These were made in a way similar to those with the guinea pigs and death resulted in from eight to ten weeks. Two rabbits remained refractory for four months and were subsequently inoculated intravenously, which proved them not to be insusceptible to the disease. It was, therefore, conceded that they did not receive a sufficient quantity of the contaminated food and water to become affected. The results were practically the same as with guinea pigs, and as was the case with these, no intestinal lesions could be detected. It might, therefore, be concluded that in entering the system from the intestinal tract the bacillus in question selects the portal circulation exclusively, or else that the lacteals and the mesenteric glands are able completely to destroy it after entering them.

EXPERIMENTS ON MICE.

Subcutaneous inoculation.—Five hundredths of 1 cc. of a bouillon culture injected subcutaneously at the base of the tail results in death in the course of five days. The post-mortem examination shows a necrotic area at the point of inoculation with caseous material permeating the adjacent subcutaneous tissue. The liver is well dotted with pin-point foci of the usual appearance.

The spleen is slightly swollen and the surface uneven, showing similar small necrotic centers.

The lungs show caseous foci scattered over the surface.

Intra-abdominal inoculation.—The same-sized dose of a similar culture, when injected into the abdomen, proves fatal on the third day. The day following the inoculation the animal refuses to eat, and sits haunched up in a corner with coat ruffled and eyes closed. The lesions observed on post-mortem examination are almost identical with those produced in guinea pigs by the same method. The abdominal cavity contains a turbid fluid and fibrous adhesions, attaching the liver to the abdominal wall. The spleen appears more swollen than by the subcutaneous method and is covered with caseous foci. The abdominal lymph glands are soft and swollen, but do not appear to be caseous. The liver is swollen, with a limited number of foci. The other organs are apparently normal.

EXPERIMENTS ON PIGEONS.

Experiments on pigeons were made by intravenous and intramuscular inoculations and by feeding. After an injection of 0.1 to 1 cc. of a 2-days-old bouillon culture into the wing vein, no evidence of the disease was manifest after a period of from three to four months. Pigeons inoculated intramuscularly with 0.3 to 1 cc. of a similar culture did not appear affected four months after injection, and no apparent changes were observed at the point of inoculation. When chloroformed no alterations could be detected in the viscera of the birds, nor did cultures become fertile when inoculated with material

from the various organs. Feeding experiments after twenty-four hours of fasting, and conducted in the same manner as with rodents, likewise gave negative results.

EXPERIMENTS ON FOWLS.

Six roosters were inoculated with from 0.3 to 1 cc. of a 2-days-old bouillon culture by intravenous and intramuscular inoculations. Feeding experiments were also conducted. After a period of four months the fowls were chloroformed, and the post-mortem revealed absolutely no alterations in the organs or tissues of the birds.

EXPERIMENTS WITH SHEEP.

Intravenous inoculation.—On January 10 an adult male sheep was inoculated into the jugular vein with 0.5 cc. of a filtered emulsion, made by mixing the caseous contents of a sublumbar lymph gland of a rabbit with a normal salt solution. On the third day after injection the animal appeared languid and began to lose flesh. On January 24 it weighed 126 pounds, on February 5, 122 pounds, and on March 3, 113 pounds. After that time the animal began to recover and gained in flesh until two weeks later, when it was killed. On post-mortem examination the lungs were found to be studded with numerous pearly white nodules the size of beans. These nodules had all the characteristic appearances of the lesions observed in caseous lymph-adenitis; that is, a thick, grayish white, fibrous capsule inclosing a mass of greenish yellow cohesive pus. A similar nodule was observed in the liver. This too had been entirely walled off and seemed to have reached the end of its development. The left pre-scapular and sublumbar lymph glands were considerably enlarged, but no degenerative foci could be observed in either of them. Pure cultures of the bacillus of Preisz were obtained from the nodules in the liver and lungs.

On April 30 a yearling sheep was inoculated intravenously with 1 cc. of a 2-days-old bouillon culture. The animal developed all the symptoms of acute septicemia, and was found dead on the evening of the fifth day. This was, unfortunately, on a Saturday, and when the carcass was brought to the laboratory on Monday morning decomposition had set in to such a degree as partially to obscure the pathological lesions.

A post-mortem showed, however, the pre-scapular glands enlarged and edematous. The lungs were highly congested; the liver enlarged and fatty degenerated; the spleen soft and friable; the kidneys flabby

DESCRIPTION OF PLATE XXX.

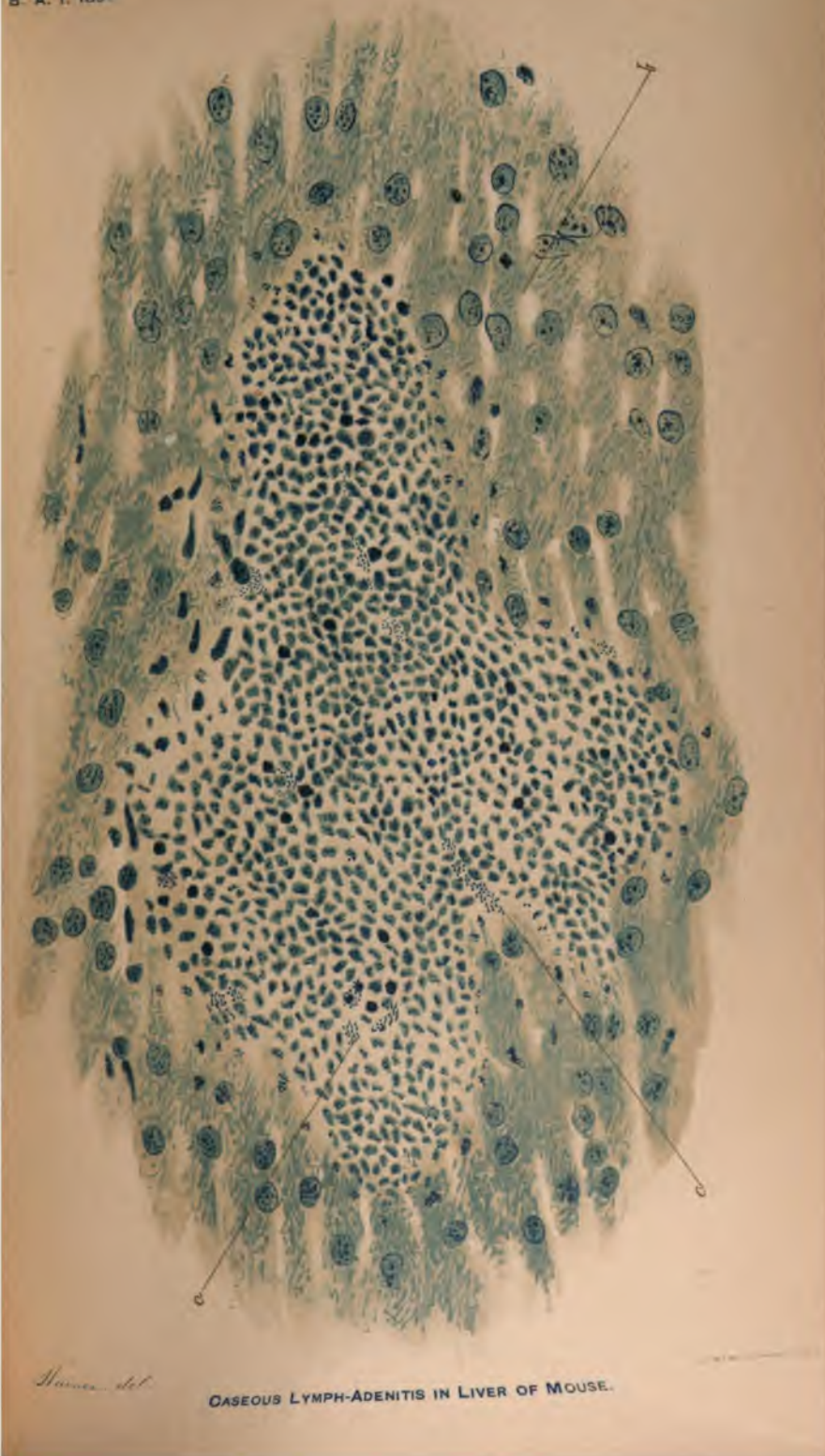
Minute abscess in the liver of a mouse which had died five days after a subcutaneous injection. Stained with alkaline methylene blue. 1,000 diameters.

a. Clumps of bacilli.

b. Degenerated liver cells.

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PLATE XXX.



and of a very dark color; blood thick and tarry. No caseous foci were observed in any of the organs. No bacteriological examination was made.

Subcutaneous inoculation.—On January 10 an adult sheep was injected subcutaneously on the inside of the left thigh with 0.5 cc. of the same gland emulsion as that which was used for intravenous injection on the first-mentioned sheep. In the course of two days an extensive inflammatory swelling developed at the point of inoculation and caused the animal to go lame. In the course of a week the inflammation disappeared and a large abscess developed. This did not open until February 9, nearly one month after the inoculation, when a great quantity of thick creamy pus was discharged. The wound healed without difficulty, leaving only a fibrous induration under the skin. On April 27, when the animal was killed, this induration was found to contain three small abscesses the size of hazel nuts, containing the characteristic greenish yellow cohesive pus. No other lesions were found in any part of the carcass.

On April 30 a yearling sheep was inoculated subcutaneously with 1 cc. of a 2-days-old bouillon culture. In the course of two days the animal became droopy, and from then on continued to lose flesh until it died on May 10. On post-mortem the muscles at the place of inoculation (the inside of the thigh) were found to be swollen and contained a large necrotic center. The adjoining lymphatic glands were greatly enlarged, containing foci of caseous material. The lungs contained a number of small foci the size of millet seeds. No lesions were found in any of the other organs.

On June 3 another adult sheep was inoculated subcutaneously in the left axillary region with 1 cc. of a 4-days-old bouillon culture. The animal soon began to droop, lose its appetite, and at the end of the second week had lost 11 pounds in weight. On July 31 the sheep was slaughtered, and on post-mortem examination was found to be very anemic and greatly emaciated. At the point of inoculation a large abscess had formed and had become encapsulated in a thick fibrous membrane. The left prescapular gland was greatly enlarged and showed, on section, a number of greenish yellow foci. The lungs contained eight or nine nodules, varying in size from that of a millet seed to that of a pea. The nodules were all situated on the surface directly under the pleura, and were surrounded by apparently normal lung tissue. The liver was somewhat enlarged and showed two small caseous foci in the middle lobe. In one of the mesenteric glands three small caseous foci were observed, from which pure cultures of the characteristic bacillus were obtained. This is the only instance where the writers have observed an infection of the mesenteric glands. All the other organs were normal.

Feeding experiments.—On January 30 two adult sheep were fed a small quantity of oats and bran which had been moistened with 30 cc.

of an emulsion from a number of caseous lymph glands of a rabbit which had just died from an experimental infection. The material was eaten at once, but the animals continued to thrive and put on flesh. When slaughtered after forty-nine days none of the characteristic lesions could be observed in any of the organs.

ECONOMIC IMPORTANCE OF CASEOUS LYMPH-ADENITIS IN SHEEP.

As already stated, the disease in question is but little known to either the sheep raisers or to the practicing veterinarians of this or any other country where it prevails. Only the meat inspectors have an opportunity to become familiar with the lesions, as by far the greater majority of affected animals show no symptoms during life. This is evidently due to a faculty possessed by the ovine species of localizing the infection after it has gained entrance to the system. The characteristic encapsulated condition of the lesions demonstrates clearly that the system, when in prime condition, reacts immediately and throws an insurmountable barrier around the center of infection. Like tuberculosis, caseous lymph-adenitis is preeminently a disease of the lymphatics, and remains, under favorable conditions, confined to these. Only when the vitality of the animal is lowered, for some reason or other, do the microorganisms gain entrance to the circulation and cause lesions to develop in the other organs. It is therefore unquestionable that the prognosis in all cases where young animals are affected must be considered good, and, as 95 per cent of all sheep go to market before they reach the dangerous age, there is, so far as we are able to judge with our present knowledge of the disease, no reason to look upon its spread with apprehension.

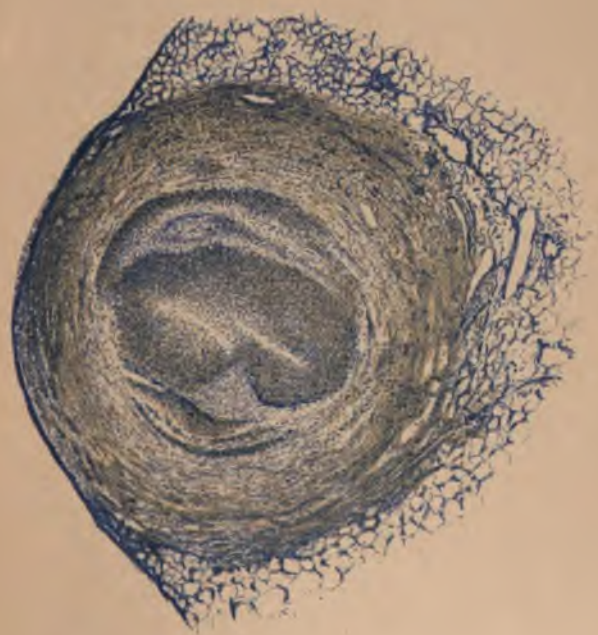
It is, as previously stated, doubtful whether the appearance of the disease in this country is of recent origin, and many facts, especially its benign nature and its wide spread, would seem to indicate that caseous lymph-adenitis is a disease which has prevailed for centuries. The very fact that the disease has not assumed a more virulent form during the past few decades, when the great majority of the native sheep have been graded up by means of veritable hot-house strains of pure blood, indicates that we are dealing with a disease, the virulence of which is not what it has been, and consequently one which we need not fear will threaten with ravages the further improvement of the sheep stock of this country. If the disease were a new one or one whose once attenuated virulence were recrudescing with the improvement of the sheep breeds and their subsequent greater susceptibility to infection, then it would not seem probable that each individual should be possessed of such a remarkable power of resist-

DESCRIPTION OF PLATE XXXI.

Caseous focus from the lung of a sheep inoculated subcutaneously, showing the concentrically arranged structure surrounded by normal lung tissue. Stained with toluidin blue. Magnified about 25 diameters.

B. A. I. 1899.

PLATE XXXI.



H. J. H. del.

CASEOUS LYMPH-ADENITIS IN LUNG OF SHEEP.

UNIVERSITY OF CHICAGO PRESS, CHICAGO, ILL.

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ance to it. In bovine tuberculosis an individual tendency to localize the disease by means of an encapsulating process has been observed frequently, but this is, unfortunately, the exception and not the rule. It would therefore seem reasonable to conclude that the ovine species has not acquired this faculty except through the exposure to the infection of an indefinite number of generations.

As to the prevalence of the disease in this country the following statistics, obtained from the official abattoirs in Chicago, Kansas City, and South Omaha, may furnish some information.

Percentage of sheep slaughtered at the official abattoirs in Chicago, Kansas City, and South Omaha during 1897-1900, inclusive, which have been totally condemned for caseous lymph-adenitis.

	Fiscal year.	Number slaughtered.	Number condemned.	Per cent condemned.
Chicago	1897	2,637,165	380	0.014
	1898	2,911,454	78	.0028
	1899	2,743,523	196	.007
	1900	2,334,390	294	.01
		11,226,538	946	.....
Kansas City	1897	769,847	128	.016
	1898	686,085	51	.0074
	1899	620,870	114	.018
	1900	606,775	340	.056
		2,684,183	633	.....
South Omaha	1897	357,763	2	.0006
	1898	511,756	16	.003
	1899	635,418	702	.12
	1900	701,606	847	.12
		2,206,603	1,657	.....
Total		16,117,324	3,236	.02

The above table shows that out of more than 16,000,000 sheep slaughtered during the past four years only 3,236 were condemned for caseous lymph-adenitis or for diseases which on inspection might be confounded with it. In fact these 3,236 sheep represent all those which on post-mortem examination were found to suffer from "abscesses," "pyemia," or "pseudo-tuberculosis" to a degree which would warrant their condemnation as unfit for food. It has been ascertained, however, from the inspectors in charge of the various abattoirs that the above-mentioned conditions in nearly every instance referred to more or less advanced cases of lymph-adenitis.

In response to an inquiry addressed to the inspector in charge of the Chicago abattoirs, where more than 11,000,000 of the above-mentioned 16,000,000 sheep have been slaughtered, the following information was received:

Of the sheep condemned here on account of abscesses, 75 per cent were affected with lesions similar in character but in some respects unlike the common collec-

tion of pus resulting from inflammatory processes. Those observed in the thoracic cavity were most frequently located in the mediastinal and the bronchial glands, and in advanced cases in the lung tissue. The abscesses varied in size from a millet seed to a clenched fist, or even larger, and contained caseous material of a yellowish white color with a greenish tinge. The capsule was fibrous in character. When located in the flank or prescapular region they were not considered sufficient cause for condemnation. The lesions were in nearly all cases confined to mature Southwestern stock. In no case have the submaxillary, retropharyngeal, or mesenteric glands been found infected.

One of the inspectors at South Omaha, Nebr., writes as follows:

The animals most frequently affected are old ewes which have been used during a number of seasons for breeding purposes. As a rule they are in a fairly good condition, although a number of them show a certain degree of emaciation.

In the thoracic cavity the mediastinal and bronchial glands are found to be greatly enlarged and filled with a caseous mass. The parenchyma of the lungs in some cases contain nodules and abscesses varying in size from a pea to a large walnut. When located near the surface they sometimes cause pleuritic adhesions. The lymph glands in the prescapular and inguinal region may be similarly affected, either separately or accompanied by lesions in the thoracic cavity. So far as the inspection is concerned, I would say that when the lesions are limited in number and the carcass in good condition we allow it to pass for food. In more advanced cases with pleuritic adhesions and the carcass in poor condition it is totally condemned.

The inspector in charge of the abattoirs at Los Angeles, Cal., says:

Replying to your letter of recent date, I beg to submit to you the following observations regarding the disease known as pseudo-tuberculosis in sheep:

Symptoms.—I have closely observed several flocks of sheep in which subsequent post-mortem examination showed the characteristic lesions in various stages, but I have failed to notice anything of prominence with the exception, perhaps, in a few cases of an enlarged condition of the prescapular and superficial inguinal glands. An occasional cough might be heard, but as this might be due to many other causes no importance can be attached to it for diagnostic purposes.

The affected sheep feed well and seem in every respect to thrive as well as neighboring flocks which are not affected.

Course and termination.—As I have not had an opportunity to observe any of the affected flocks for any length of time, it is impossible for me to define correctly the course of this disease, but judging from the post-mortem appearances there can be no doubt that it is extremely slow in progress. It must, however, be considered characteristic that lambs seem to be immune from it. More than 3,500 lambs coming from the infected districts have been slaughtered here lately, and of these only one was found to be affected to a very slight degree.

Sheep from 1 to 2 years old are, as a rule, but slightly affected, the lesions being confined to the mediastinal glands, with an occasional small caseous center in the lungs. In these younger animals the lesions contain more or less pus of a yellowish green color and of a rather thick consistency, while in sheep past 2 years old the lesions are more extensive and the contents of a more caseous nature. In older ewes the affected lymph glands contain dried caseous or even mealy material in which calcareous particles may sometimes be noticed.

Economic importance.—A careful post-mortem examination of 950 sheep originating from the infected districts showed 82 head to be affected with the disease in question. Of these 950 sheep 756 were wethers, of which number 59 were found to be affected, that is, 7.8 per cent. The balance (194) were ewes, of which 23 were affected, or about 12 per cent. All the wethers were between 1 and 2 years of age, while the ewes were past 5 years. These ewes were old breeding

sheep, and the period of usefulness as such having come to an end they were fattened for slaughter. All of the ewes showed more extensive lesions than did the wethers. This I consider due to their more advanced age, which would give the disease in question time to invade a greater amount of tissue.

All the affected sheep dressed out in good shape and compared favorably to sheep of the same class which were not affected. Up to the present time I have only seen one sheep affected with this disease which was sufficiently emaciated to warrant the condemnation of the carcass.

Fatal cases from this disease are very rare, in fact I have heard of none, and sheep men whom I have questioned are entirely ignorant of its existence.

PUBLICATIONS CONSULTED RELATIVE TO THE SUBJECT IN QUESTION.

All the authors who have investigated the disease in question, no matter what name they have given it, have found as the cause the bacillus of Preisz. The latter author, in conjunction with Guinard, called the disease pseudo-tuberculosis, and the same name was applied to it by Turski and Ostertag. Sivori calls it caseous broncho-pneumonia, while Cherry and Bull applied the term caseous lymphatic glands or pseudo-tuberculosis of sheep. As a matter of convenience, however, a number of other authors have used the name pseudo-tuberculosis for a series of pathological alterations, whether of mycotic or parasitic origin, whenever the macroscopical appearance of the lesions had any resemblance to those of tuberculosis.

For the benefit of those who may wish to make a comparative study of these various forms of pseudo-tuberculosis and their specific causes, a complete bibliography is appended, but as a great majority of these publications refer to diseases which are in no respect related to caseous lymph-adenitis in sheep, it will not be necessary to discuss them here.

Of interest are, however, the publications of Nocard (26) and Kitt (15). The former in 1892 investigated an outbreak of ulcerative lymphangitis in horses, which closely resembled farcy. From these lesions he isolated a bacillus that stained by Gram's method. Not until 1897, however, after he had opportunity to study the bacillus of Preisz did he observe that the two microorganisms were identical. He calls attention to the fact that the bacillus obtained from the horses when inoculated intra-abdominally produces orchitis in guinea pigs similar to the bacillus of glanders. The authors of this paper, however, in only one case have seen this condition result from an intra-abdominal inoculation with material from a caseous lymph gland. Sivori claims that there can be no doubt regarding the identity of the two bacilli.

Kitt described a caseous broncho-pneumonia in cattle which, judging from his description of the causative bacillus, must have been identical with the bacillus of Preisz, but as he did not succeed in cultivating the bacillus, and as inoculation experiments gave negative results, the diagnosis is based simply upon the morphology of the bacillus in question and upon the fact that it stained readily by Gram's method.

CONCLUSIONS.

Caseous lymph-adenitis is an infectious disease, caused by a specific microorganism—the bacillus of Preisz—which is pathogenic to mice, guinea pigs, rabbits, and sheep (horses and cattle ?) and nonpathogenic to chickens and pigeons.¹

The disease prevails in certain districts of the western part of the United States, but owing to its benign nature and very chronic course its presence is seldom noted except on post-mortem examination of the affected animals.

All classes of sheep, whether pure blood, graded, or common stock, are equally susceptible, but only in a small percentage of them—the older breeding ewes—do the lesions develop sufficiently to interfere with nutrition. Fatal cases are practically unknown, and the loss resulting from the rejection of carcasses with extensive lesions, in the official abattoirs, is insignificant.

The same disease has been observed and described under various names in Europe, South America, and Australia, but in none of these places does it prevail to any serious extent.

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NOTES ON THE ANIMAL INDUSTRY OF PORTO RICO.

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Probably second only to coffee is the grazing industry of Porto Rico, although sugar and tobacco figure more largely than meat or live stock among the exports of the island. The local markets consume most of the animal food products, and others are imported, though to a limited degree, the imports aggregating nearly \$2,000,000 annually and the exports averaging about \$200,000. The local consumption of home-grown meat, however, reaches \$5,000,000 or more, so that the total value of the live stock must be several times that amount:

GRASSES.

Grazing is not an industry to which many tropical countries are adapted, and certainly very few can compare with Porto Rico in this respect. The extremely tenacious clay soil favors the luxuriant growth of grass, and, if the woody vegetation be held in check, the pastures are permanent and perennial. There are numerous native grasses, some of which are said to afford fairly good forage, but none of them are cultivated, the two used in agriculture being the Guinea grass (yerba de Guinea) and the malojillo, or Para grass. The former is much more extensively planted, and is used in all places not too wet. In swampy meadows recourse is had to malojillo. The Guinea grass grows in bunches and sends up long stems to a length of 6 feet or more, although the leaves scarcely reach more than half that height. The malojillo is deeper green in color, decumbent at base, has very hairy joints, and the flower stalk has fewer and shorter branches. Both species produce luxuriant crops, but both seem too coarse to represent the food value of the same amount of the temperate grasses, though analysis of Guinea-grass hay has shown that the quality is good when cut at the right time.

Some interesting experiments, designed to ascertain the yield and food value, have been reported recently from the Trinidad Botanic Gardens. Six cuttings were made on and between February 12 and December 9, with a total yield of 75 tons of green fodder per acre. This loses about 63 per cent in drying, leaving about 28 tons of hay, of which 33 per cent is woody and inedible, reducing the available dry fodder to 18½ tons, produced without manure or special preparation of soil. It is claimed that as many as 118 tons of grass per acre

have been cut from rich land, or nearly 7 pounds per square foot. Analysis of this crop shows albuminous compounds slightly in excess of those of clover hay, but the carbonaceous and fibrous material is given as about 20 per cent less.

The continuous growth and enormous production render the Guinea grass the most advantageous fodder crop in spite of this deficiency. If it could be supplemented by some equally good leguminous plant, the conditions for stock raising would leave little to be desired. That its quality and wholesomeness must be of the best is evidenced by the fact that horses and cattle thrive and work on an unvarying and unsupplemented diet of green fodder. What results would follow from the use of a properly developed and balanced ration can only be conjectured.

Cattle partly hidden in the tall Guinea grass are no uncommon sight in luxuriant Porto Rican pastures, which could scarcely be duplicated in the United States. Throughout the entire island a large part of the land is given up to grazing, which, on account of the recent depression in the markets for the local agricultural products, has received great impetus as the safest and most profitable business in which the farmer could, for the present, engage.

QUALITY AND PRICES OF MEAT.

Meat seemed to be selling in Porto Rican markets at prices not greatly different from those which prevail in cities of our Eastern States. Accurate information, however, is hard to secure, since the butcher's art seems not to be highly developed, the animals being cut indiscriminately in pieces and thus sold for the same price throughout. There is a prevailing impression among Americans that Porto Rican beef is extremely tough, but on inquiry it was learned that this is explainable by the fact that few animals are killed except the old and worn out. With the industry rapidly expanding, the tendency is to keep the cows as long as possible for breeding purposes, while draft oxen are also too valuable to be sacrificed while still vigorous. The wretched condition of the country roads requires the use of oxen instead of horses for all heavy work, and much larger numbers are also necessary than would be the case if the highways were improved. It is accordingly quite probable, and in a few instances there was tangible evidence of the correctness of the opinion, that excellent beef can be produced in Porto Rico, provided the animals be killed before they become superannuated. The presence of discriminating American buyers may be expected to have an effect on the local methods of slaughtering and marketing.

DAIRY PRODUCE.

The dairy is emphatically not a tropical institution, and it is doubtful whether it will ever be successfully transplanted into warm coun-

tries. Very little butter is made in Porto Rico, and none of the domestic product is met with on the fonda¹ tables, the canned imported article being in evidence. For the use of the wealthier classes of the town populations annual importations of butter to the value of about \$70,000 were made under the Spanish régime, an amount which will undoubtedly be greatly increased by the demands of resident Americans. Butter in the tropics, even when properly preserved, is not entirely satisfactory, and the price which obtains in temperate climates places it beyond the reach of anything like popular use. The imported butter comes from a variety of sources, but largely by way of Spain. At Caguas, a small interior town, we were surprised to find on the fonda table a small can of preserved butter put up at Milan, Italy. The quality was very low, but age may have been an element in the deterioration. At other places Danish and other European butters were found, but none of the American article came into our hands. Imports of butter from the United States to Porto Rico have declined in the last decade, perhaps because of the advances made in Europe in methods of canning and preserving.

A small amount of cheese of very poor quality, so far as we had opportunity for judging, is also made in Porto Rico, but a much larger quantity is imported than in the case of butter, the annual average considerably exceeding \$300,000. Nearly all of this comes from Europe, the American contribution seldom exceeding \$30,000 in value.

About the larger towns there are already dairies in operation, and these are said to be profitable at the prevailing high price of milk—about 10 cents per quart. Milk is carried to market in American milk cans, as shown on Plate XLI, fig. 2. Porto Rican cattle have evidently not been selected for milk production, this phase of the grazing business being quite incidental. The larger land owners, of course, have their private herds of milch cows, such as those shown on Plates XXXII and XXXIII, and are easily able to make up in numbers any lack of productiveness for family use. The prevalence of the curious notion that a cow will not give milk unless the calf is tied near by seems to indicate incomplete domestication from the dairy standpoint.

BREEDS OF CATTLE.

As shown by the illustrations, Porto Rican cattle seem to belong to a separate insular breed rather than to any recognized in the United States. There is some diversity of color, but such exceptions are comparatively few, the prevailing hues being dull reds and fawns. The hair is very short. Local opinion is to the effect that the cattle of Porto Rico were introduced from Africa in the times of the slave

¹ A house where travelers may secure food and usually lodging; the inn or tavern of a rural town.

trade. That this tradition may be based on fact is indicated by the similarity of the Porto Rican cattle with the native breed possessed by the Mandingoes and other tribes of the interior of Sierra Leone and Liberia.

METHODS OF YOKING OXEN.

At the time of our visit the American colony and newspapers were considerably exercised over what seemed to some the thoughtless cruelty of yoking oxen by means of thongs or bands passing around the front of the head below the horns, as shown in several of the illustrations, but especially on Plates XXXV and XXXVI. This method has been followed by the Mediterranean nations since the time of the ancient Egyptians, and when the yoking is carefully done there is nothing to indicate distress on the part of the animals. They seem to be able to exert their strength in this direct manner to quite as much advantage as with yokes of the pattern with which Americans are familiar.

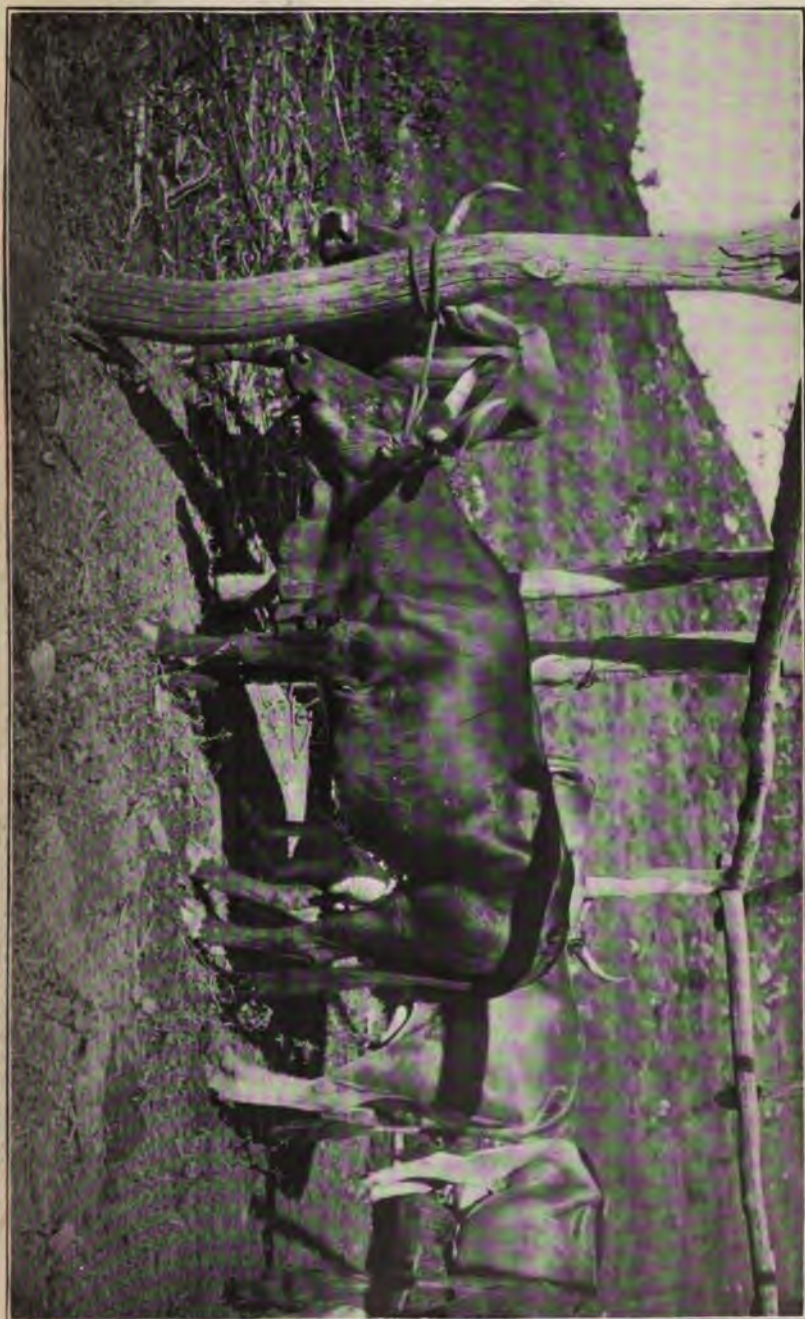
Plowing and other heavy farm work is all done by oxen, but the old wooden plows have gone out of use on the sugar plantations, though they are still employed for minor purposes in the up-land districts. Owing to the tenacity of the soil four, or even six oxen are needed for a single large plow.

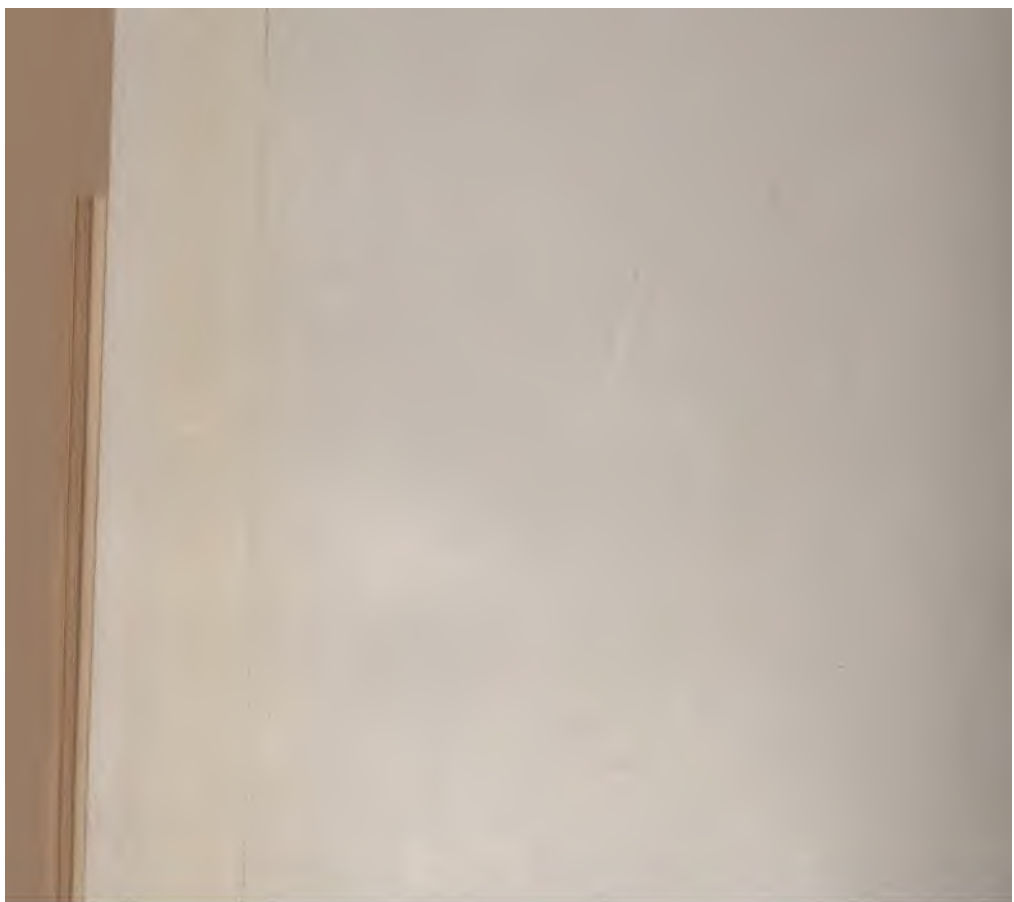
OTHER DOMESTIC ANIMALS.

Horses are used very little in Porto Rico for draft purposes. Carriages can be used only on the principal roads, while wagons loaded with heavy freight or farm produce are always drawn by oxen. The horses appear very small in comparison with the large cavalry mounts of the American Army, but are not really diminutive in size and are generally very tough and wiry. Those owned in the country are usually plump and spirited, but the town horses are often half starved, owing perhaps to the high price of grass—5 centavos (3 cents) for a very small bundle. The usual mode of travel across the island on the military road is in hired carriages and the charges are much the same as for similar service in the United States.

In country districts one must ride on horseback. Saddles of the usual types are generally obtainable, but the natives are accustomed to use a combination of saddle and panniers. (See Plates XI and XLI.) The position of the legs and the support of the body is very different from that required in a saddle and is in reality quite comfortable. Donkeys and mules are occasionally met, but both are much less common than horses.

The abundance of cattle explains the comparative scarcity of the goats, which are so general a feature in many Spanish countries. Sheep raising is not a tropical industry, though woolless breeds are kept in some countries for the sake of the mutton, which is preferable







COW AND CALF, BESOSA ESTATE, AGUIRRE, PORTO RICO.

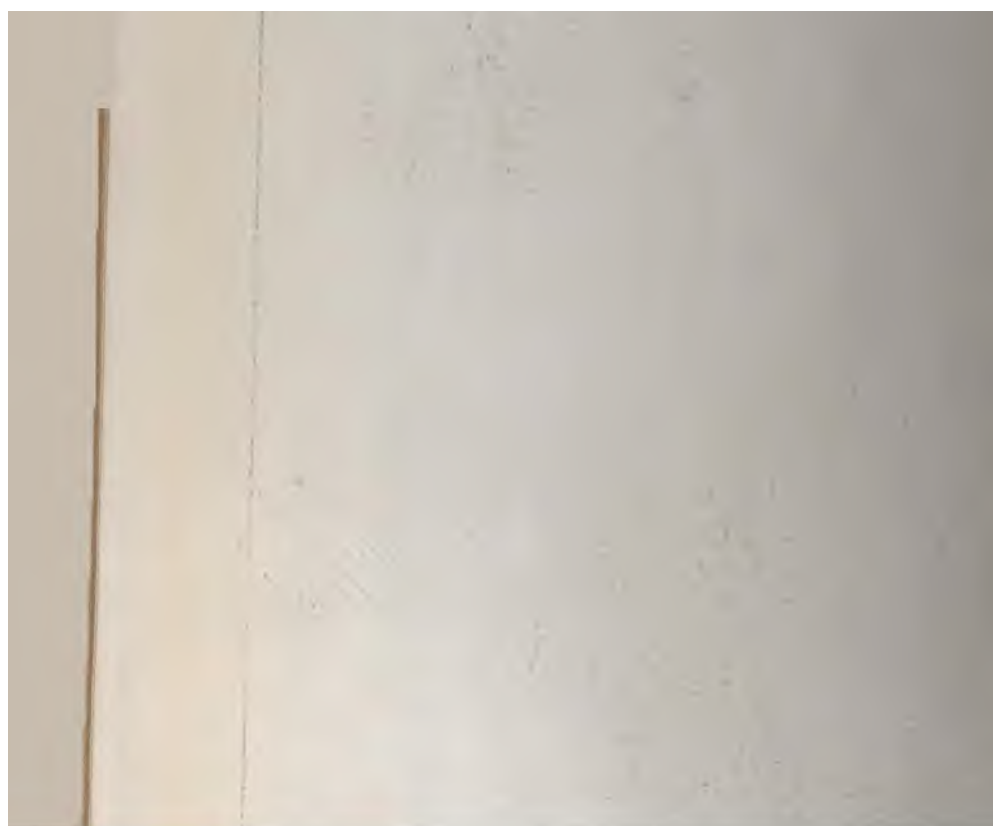




COW AND CALF, BESOSA ESTATE, AGUIRRE, PORTO RICO.

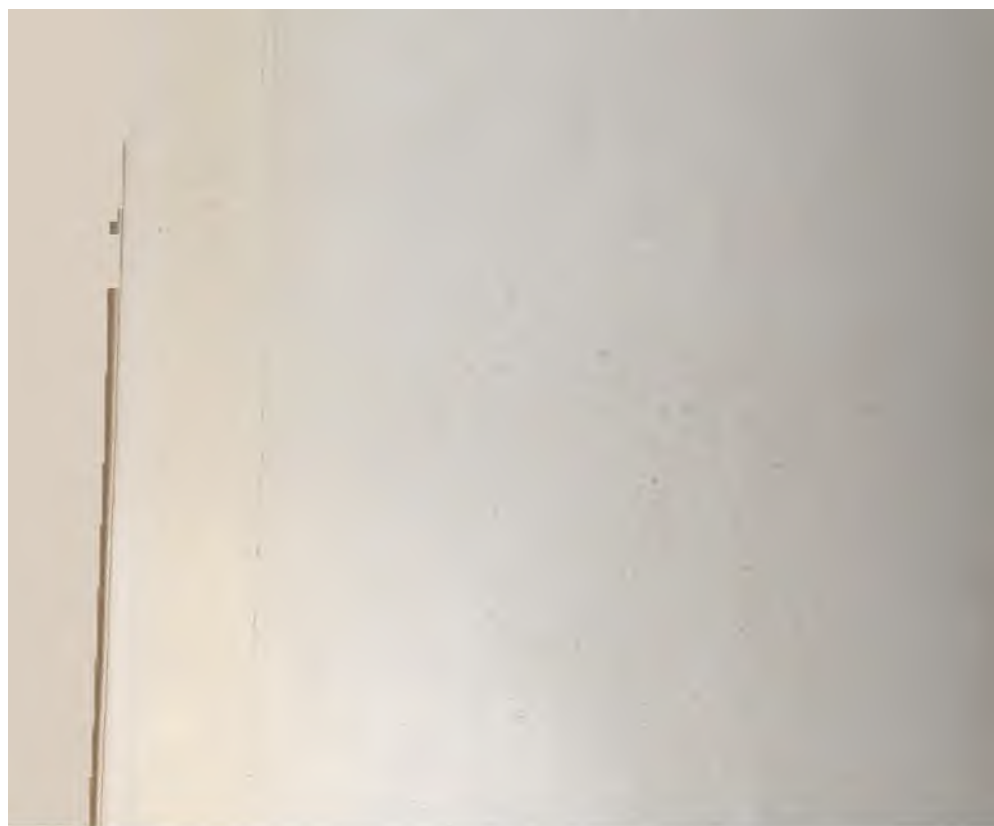








STREET IN AIBONITO, PORTO RICO, SHOWING METHOD OF YOKING OXEN.

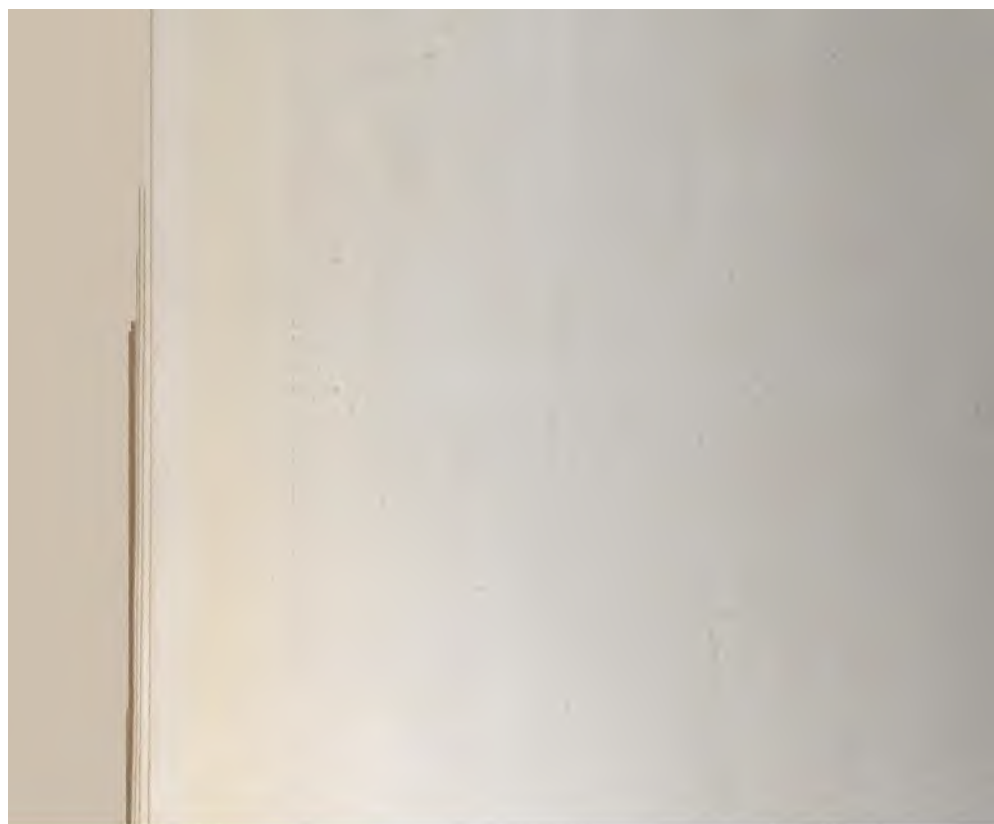








PORTO RICAN WATER CART.





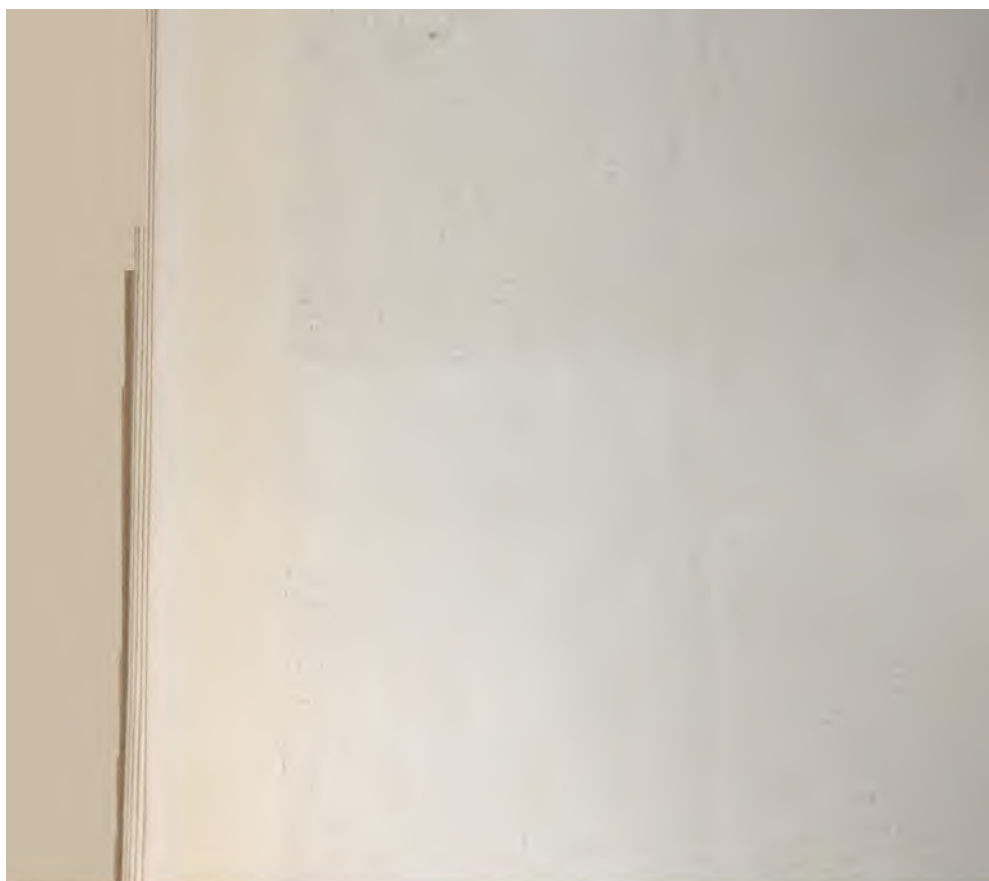




FIG. 1.—COW, NEAR SAN JUAN, PORTO RICO.



FIG. 2.—DRAFT OXEN, SAN JUAN, PORTO RICO.





FIG. 1.—DRAFT OXEN, SAN JUAN, PORTO RICO.



FIG. 2.—DRAFT OXEN, SAN JUAN, PORTO RICO.





FIG. 1.—PANNIER, SAID TO BE MADE FROM EMMAJAGUA (*VARILIMUM TILIACUM*).



FIG. 2.—HORSEMEN WITH PANNIERS, NEAR COAMO, PORTO RICO, SHOWING METHOD OF RIDING.





FIG. 1.—DONKEY, WITH PANNIERS.



FIG. 2.—MILKMAN, COAMO, PORTO RICO.

1. The first part of the document is a list of the names of the persons who were present at the meeting. The names are listed in alphabetical order.

to goat meat. Hogs are kept in considerable numbers, and some fairly good specimens were seen, particularly of a black variety, but most of them are of the "razor-back" type and lead a half-wild existence, feeding upon the nuts of the royal palm, which on that account the tree is sometimes called "palma de los cerdos," or "palm of the pigs."

POULTRY.

At a distance from the towns chicken raising is a more promising industry than dairying, and is extensively practiced, though only by the poorer classes and for immediate domestic uses. In the market eggs are 3 and 4 centavos apiece and small chickens sell for 30 to 40 centavos. The game breeds are most exclusively raised, although both the birds and their eggs are very small and the young chickens are so pugnacious as to render their growth very slow. Better stock was seen in a few places, but we heard of only one attempt at making a regular business of poultry raising, which, with the facilities for producing food crops and with ready access to a good market, ought to be profitable. The introduction of the mongoose by the sugar-growers in order to rid their plantations of rats will doubtless prove an obstacle to poultry raising in some districts, but this mischievous animal has not become at all abundant, and few complaints were heard of its ravages. The general absence of snakes and other small animals will doubtless prevent multiplication to the extent of becoming a general pest as in Jamaica. Ducks and turkeys are also kept, but in relatively small numbers, and, with occasional flocks of guinea hens and the inevitable pigeons, complete the usual list of domestic birds, unless mention be made of a small native parrot very common in cages.

NUMBERS AND VALUES OF FARM ANIMALS, 1899.

[These figures are furnished by the Division of Statistics, which dates its returns January 1, but as the figures are really for the previous year, the dates in these tables have been changed accordingly.]

State or Territory.	Milk cows.			Other cattle.		
	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine.....	208,814	\$28.90	\$5,890,225	112,723	\$38.28	\$4,313,86
New Hampshire.....	136,457	32.70	4,459,444	79,221	25.57	2,025,47
Vermont.....	268,886	31.90	8,577,463	132,450	23.41	3,100,07
Massachusetts.....	181,589	37.20	6,755,111	73,378	27.12	1,990,27
Rhode Island.....	25,266	39.95	1,008,977	10,149	29.83	302,72
Connecticut.....	144,529	34.80	5,029,009	66,188	30.90	2,045,54
New York.....	1,487,416	35.20	52,357,043	572,299	27.45	15,707,88
New Jersey.....	223,261	39.10	8,729,505	89,896	30.70	2,734,88
Pennsylvania.....	970,473	33.15	32,171,180	523,653	27.34	14,314,84
Delaware.....	35,730	31.50	1,125,495	22,305	28.03	625,24
Maryland.....	154,712	29.80	4,610,418	102,723	25.36	2,604,64
Virginia.....	242,468	24.05	5,831,936	325,000	23.96	7,787,81
North Carolina.....	243,298	18.20	4,428,024	274,843	12.31	3,383,71
South Carolina.....	122,950	19.25	2,366,961	137,204	10.77	1,478,24
Georgia.....	286,431	23.95	6,836,072	380,716	11.07	4,216,05
Florida.....	113,178	16.70	1,888,904	299,712	8.39	2,512,05
Alabama.....	231,802	18.40	4,265,157	279,278	10.96	3,061,71
Mississippi.....	244,103	20.70	5,052,932	273,706	13.59	3,719,12
Louisiana.....	123,232	21.96	2,704,942	171,729	13.37	2,296,70
Texas.....	693,794	25.25	17,518,296	4,352,541	17.86	77,736,38
Arkansas.....	188,936	20.25	3,825,954	230,486	14.04	3,235,91
Tennessee.....	239,304	24.15	5,781,365	286,841	18.79	5,390,59
West Virginia.....	167,173	28.40	4,747,713	241,025	25.15	6,061,48
Kentucky.....	235,798	27.25	6,425,496	303,651	24.52	7,446,74
Ohio.....	780,939	32.30	25,224,330	674,619	30.09	20,202,04
Michigan.....	463,698	32.70	15,162,925	338,120	26.75	9,043,68
Indiana.....	605,855	33.75	20,447,006	629,075	32.65	20,536,74
Illinois.....	1,021,236	36.20	37,070,867	1,303,018	31.62	41,197,51
Wisconsin.....	1,003,321	33.60	33,711,586	595,268	27.33	16,267,02
Minnesota.....	672,540	31.65	21,285,891	564,463	24.27	13,700,39
Iowa.....	1,263,283	34.90	44,088,577	2,178,729	33.47	72,930,79
Missouri.....	629,731	28.60	18,008,307	1,387,615	26.65	36,981,33
Kansas.....	707,675	32.50	22,999,438	2,159,540	28.90	62,401,23
Nebraska.....	685,338	35.50	24,329,499	1,521,454	30.38	46,229,26
South Dakota.....	508,383	33.40	13,365,962	480,817	29.61	14,237,27
North Dakota.....	176,235	31.95	5,629,750	255,166	27.24	6,951,26
Montana.....	45,314	39.25	1,778,574	914,494	27.19	24,865,08
Wyoming.....	18,104	40.55	734,117	729,722	28.10	20,505,91
Colorado.....	93,199	36.20	3,384,604	1,021,022	27.69	28,267,53
New Mexico.....	19,510	31.70	618,467	659,849	18.64	12,301,57
Arizona.....	19,110	32.50	622,050	632,721	16.46	5,989,23
Utah.....	57,209	32.75	1,873,595	278,867	22.93	6,386,23
Nevada.....	18,250	34.10	622,325	219,831	23.06	5,068,41
Idaho.....	33,075	31.90	1,055,092	344,833	23.77	8,172,74
Washington.....	122,414	35.40	4,333,456	268,090	25.21	6,757,57
Oregon.....	115,415	31.05	3,583,636	522,018	23.36	12,192,77
California.....	308,872	33.75	10,424,430	604,881	24.57	14,864,96
Oklahoma.....	40,715	31.90	1,298,888	283,256	25.36	7,182,52
Total.....	16,292,390	31.60	514,812,166	27,610,054	24.97	689,486,29

Numbers and values of farm animals, 1899—Continued.

State or Territory.	Horses.			Mules.		
	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine.....	109,747	\$58.02	\$6,432,826			
New Hampshire.....	55,578	57.89	3,217,455			
Vermont.....	84,388	53.50	4,514,540			
Massachusetts.....	66,017	78.07	5,154,136			
Rhode Island.....	10,384	86.37	896,906			
Connecticut.....	44,119	73.89	3,259,754			
New York.....	590,771	63.06	37,251,355	3,714	\$69.44	\$257,903
New Jersey.....	79,972	72.88	5,828,258	7,196	94.48	679,883
Pennsylvania.....	559,722	59.89	33,243,571	37,794	76.16	2,878,395
Delaware.....	31,192	59.80	1,865,221	4,879	78.56	383,207
Maryland.....	130,959	53.07	6,950,014	12,891	72.69	937,005
Virginia.....	236,279	45.70	10,797,007	30,358	59.89	2,176,305
North Carolina.....	148,164	53.50	7,926,938	112,512	63.47	7,141,558
South Carolina.....	68,319	62.03	4,237,798	98,331	74.12	7,288,769
Georgia.....	109,935	54.59	6,001,026	157,068	68.95	10,826,032
Florida.....	38,050	46.70	1,776,778	8,521	71.60	610,093
Alabama.....	133,546	45.72	6,105,518	132,321	60.16	7,961,050
Mississippi.....	203,492	43.75	8,903,707	164,713	59.16	9,743,925
Louisiana.....	145,029	36.05	5,228,953	92,722	62.95	5,837,072
Texas.....	1,125,045	20.88	23,507,407	290,562	35.18	9,166,041
Arkansas.....	234,127	33.39	7,817,264	142,594	44.52	6,348,660
Tennessee.....	308,073	43.01	13,251,442	139,164	47.89	6,664,988
West Virginia.....	150,329	43.21	6,495,281	7,294	52.08	378,300
Kentucky.....	350,978	30.54	13,879,085	96,958	45.28	4,390,251
Ohio.....	640,429	55.00	35,222,131	16,883	58.04	979,911
Michigan.....	412,462	57.59	23,752,443	2,567	64.73	166,161
Indiana.....	577,220	50.83	29,337,702	38,734	55.28	2,141,258
Illinois.....	983,233	40.31	48,480,673	78,696	53.79	4,245,658
Wisconsin.....	418,018	61.53	25,722,329	4,611	63.79	294,128
Minnesota.....	459,673	54.95	25,256,763	8,248	59.39	489,858
Iowa.....	979,390	49.84	48,810,774	31,232	54.72	1,708,906
Missouri.....	724,597	34.35	24,891,718	165,026	43.69	7,210,321
Kansas.....	732,676	36.44	26,693,780	82,586	46.35	3,827,850
Nebraska.....	658,807	42.68	28,129,512	43,876	54.35	2,384,067
South Dakota.....	287,889	39.04	11,230,671	6,626	49.84	330,266
North Dakota.....	180,391	49.35	8,902,380	6,895	67.48	465,257
Montana.....	146,781	23.79	3,491,193	878	40.44	35,509
Wyoming.....	79,813	19.12	1,354,196	1,499	48.41	72,564
Colorado.....	145,713	27.92	4,058,081	8,580	46.60	399,827
New Mexico.....	83,184	20.21	1,680,945	3,298	34.06	112,323
Arizona.....	52,431	27.03	1,417,338	1,631	37.32	61,477
Utah.....	71,710	21.58	1,547,792	1,615	35.62	57,522
Nevada.....	42,000	16.41	689,594	1,338	34.87	46,654
Idaho.....	127,821	22.40	2,863,594	889	36.91	32,810
Washington.....	171,301	39.23	6,722,893	1,470	58.91	86,596
Oregon.....	183,986	29.99	5,516,923	5,441	38.64	210,241
California.....	321,729	38.61	12,422,429	48,682	48.49	2,360,713
Oklahoma.....	59,326	24.12	1,213,970	9,584	36.53	350,107
Total.....	13,537,524	44.61	603,969,442	2,086,027	53.56	111,717,002

Numbers and values of farm animals, 1899—Continued.

State or Territory.	Sheep.		
	Number.	Average price.	Value.
Maine.....	254,027	\$3.10	\$787,484
New Hampshire.....	79,072	3.19	252,229
Vermont.....	109,259	3.61	611,333
Massachusetts.....	40,194	4.55	182,883
Rhode Island.....	10,608	3.86	40,974
Connecticut.....	31,808	3.90	124,134
New York.....	846,165	4.07	3,448,122
New Jersey.....	42,722	4.34	185,384
Pennsylvania.....	814,322	3.60	2,932,372
Delaware.....	12,502	3.67	45,892
Maryland.....	138,177	3.51	485,533
Virginia.....	370,918	3.09	1,128,033
North Carolina.....	235,200	1.62	379,920
South Carolina.....	61,217	1.70	104,069
Georgia.....	294,826	1.75	515,845
Florida.....	76,074	1.69	128,555
Alabama.....	171,799	1.53	262,751
Mississippi.....	215,748	1.56	336,486
Louisiana.....	113,205	1.58	178,863
Texas.....	2,416,721	1.92	4,640,003
Arkansas.....	108,957	1.67	181,756
Tennessee.....	251,735	2.37	596,601
West Virginia.....	426,814	3.19	1,361,244
Kentucky.....	549,832	3.01	1,635,004
Ohio.....	2,839,690	3.71	10,535,259
Michigan.....	1,389,073	3.58	4,972,881
Indiana.....	677,905	4.00	2,711,620
Illinois.....	637,719	3.97	2,531,865
Wisconsin.....	744,656	3.65	2,718,184
Minnesota.....	419,218	3.18	1,331,113
Iowa.....	619,476	4.02	2,489,894
Missouri.....	597,619	3.10	1,852,711
Kansas.....	275,118	3.04	836,354
Nebraska.....	322,057	3.29	1,059,567
South Dakota.....	381,882	3.29	1,256,192
North Dakota.....	374,110	3.16	1,182,088
Montana.....	3,884,179	2.84	11,017,474
Wyoming.....	2,840,190	3.51	9,969,066
Colorado.....	2,185,327	2.86	6,250,036
New Mexico.....	3,973,439	2.17	8,622,362
Arizona.....	1,024,430	2.34	2,397,363
Utah.....	2,370,983	2.59	6,139,339
Nevada.....	657,773	2.91	1,914,129
Idaho.....	2,638,662	2.80	7,448,254
Washington.....	790,217	3.13	2,473,279
Oregon.....	2,446,695	2.67	6,532,675
California.....	2,001,501	2.85	5,704,282
Oklahoma.....	33,094	2.52	83,398
Total.....	41,883,085	2.93	122,665,917

NOTE.—The Statistician made no estimate of the number of hogs for this year.

THE WORLD'S WOOL CLIP, 1899.

The following statement shows the estimate in pounds of the world's 1899 wool clip, made by the National Association of Wool Manufacturers. For 1898 the estimate was 2,689,614,124; in 1897, 2,652,039,191; in 1896, 2,582,103,000.

Europe:

United Kingdom	¹ 128,312,215	
Russia and Poland	361,100,000	
France	103,610,000	
Spain	102,600,000	
Germany	49,590,000	
Austria-Hungary	64,300,000	
Italy	² 21,451,000	
Portugal	13,400,000	
Sweden and Norway	8,200,000	
Turkey and Balkans	67,500,000	
All other	14,000,000	
		945,063,215

North America:

United States	² 272,191,330	
British provinces	12,000,000	
Mexico	5,000,000	
		289,191,330

South America:

Argentine Republic	370,000,000	
Chile	7,500,000	
Brazil	1,500,000	
Uruguay	90,000,000	
Venezuela	15,000,000	
All other	20,000,000	
		504,000,000

Central America and West Indies

5,000,000

Asia:

Russia	60,000,000	
British India	85,000,000	
Asiatic Turkey	39,000,000	
Central Asia	46,000,000	
China	35,000,000	
All other	15,000,000	
		280,000,000

Australasia

520,000,000

Africa:

Algeria and Tunis	30,425,000	
Egypt	3,000,000	
Cape Colony, Natal, and Orange Free State	105,000,000	
All other	1,000,000	
		139,425,000

Oceania

50,000,000

Total		2,732,679,545
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¹ Fleece washed.

² Washed and unwashed.

WOOL CLIP OF THE UNITED STATES, 1899.

State or Territory.	Average weight of fleece.	Wool, washed and unwashed.	Shrinkage.	Scoured wool.
	Pounds.	Pounds.	Per cent.	Pounds.
Maine	6	1,425,012	42	835,307
New Hampshire	6.5	495,144	55	221,814
Vermont	6.75	1,074,168	56	472,634
Massachusetts	5.75	228,793	45	125,836
Rhode Island	5.5	57,167	42	33,137
Connecticut	5.5	170,582	41	100,643
New York	6	4,885,020	50	2,442,510
New Jersey	5	205,785	47	109,066
Pennsylvania	6	4,525,422	52	2,172,598
Delaware	5	62,955	46	33,066
Maryland	5	640,515	47	339,475
Virginia	5	1,755,250	42	1,018,046
North Carolina	5	1,228,580	43	700,284
South Carolina	5	308,745	44	173,897
Georgia	4	1,218,612	40	731,167
Florida	4	310,652	42	186,178
Alabama	4	715,768	40	429,464
Mississippi	4	887,920	42	514,994
Louisiana	4.5	471,348	50	235,674
Texas	6.5	15,493,725	70	4,648,118
Arkansas	4.25	471,716	42	273,585
Tennessee	4.25	1,119,722	40	671,830
West Virginia	5.5	2,228,886	48	1,168,021
Kentucky	5	2,719,275	37	1,713,146
Ohio	5.5	14,371,833	51	7,042,189
Michigan	6.75	9,065,270	53	4,293,677
Indiana	6.25	4,000,819	57	1,720,332
Illinois	6.25	3,671,481	50	1,835,740
Wisconsin	6.5	4,544,208	50	2,272,104
Minnesota	6.75	2,707,655	56	1,191,368
Iowa	6.75	3,945,483	57	1,691,558
Missouri	6	3,552,444	50	1,776,222
Kansas	8	1,784,898	68	571,138
Nebraska	8	2,255,576	66	768,596
South Dakota	6	2,089,256	60	839,732
North Dakota	6	2,113,002	60	845,200
Montana	6.8	21,887,854	62	8,317,394
Wyoming	7.75	10,508,000	67	5,447,841
Colorado	6.5	10,126,175	68	3,280,270
New Mexico	4.5	13,248,445	53	6,226,769
Arizona	7.75	7,389,082	72	2,068,945
Utah	6.25	12,542,925	66	4,264,565
Nevada	7.5	4,132,721	68	1,322,471
Idaho	7.5	16,294,073	67	5,367,144
Washington	8.5	6,219,543	72	1,741,472
Oregon	8	19,058,464	70	5,717,538
California	7	14,086,653	66	5,789,462
Oklahoma	7	159,425	68	54,254
Total	6.46	238,436,509	60	93,705,671
Pulled wool		33,754,761	40	20,232,857
Total product		272,191,330		113,938,528

FARM ANIMALS AND THE MARKETS.

The accompanying tables show the receipts and shipments of farm animals at leading stock centers and the range of prices at Chicago. Many duplications occur in the statements, due to the circumstance that animals received at one city may later on appear as receipts in another, and therefore an accurate estimate of the number of cattle marketed can not be made; but the summary on its face shows that the receipts of all kinds of animals except hogs increased slightly over the year 1898. The decrease in the receipts of hogs was 365,274.

A summarized statement of the receipts and shipments for 1897 to 1899 is given below.

Receipts and shipments of farm animals, 1897-1899.

Animal.	1897.		1898.		1899.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Cattle.....	8,982,215	5,728,435	9,529,430	4,502,216	9,721,577	4,302,421
Calves.....	780,222	240,462	768,864	176,766	1,018,217	197,335
Hogs.....	30,453,688	14,046,765	34,370,109	10,890,858	34,004,835	9,964,286
Sheep.....	13,074,548	6,674,315	13,100,157	5,679,200	13,343,559	5,606,431
Horses and mules.....	316,992	287,068	549,327	465,707	634,435	466,522
Total.....	153,607,665	26,977,045	58,317,887	21,654,747	58,722,623	20,536,995

The difference between the receipts and shipments represents those animals sold for packing purposes, for city slaughter, or to farmers for stockers.

The value placed by the stockyards companies upon the receipts of animals is shown for three cities in the following statement. Chicago alone gives the kinds of animals:

Value of receipts of farm animals, 1899.

Chicago:	
Cattle.....	\$123,207,854
Calves.....	1,640,112
Hogs.....	79,734,233
Sheep.....	16,572,744
Horses and mules.....	12,556,237
Total.....	233,711,180
Kansas City (all animals).....	120,946,439
Denver (all animals).....	13,323,492

The value at Chicago and Kansas City was greater than on any previous year, the increase for Chicago being \$4,409,884 over 1898, and for Kansas City \$8,305,826. At Denver the greatest value was in 1898, the decrease in 1899 being \$1,491,835.

By reference to the table showing prices at Chicago for 1899 it will be observed that prices of cattle ruled higher than for several years, and the prices of hogs was higher than during any other year since 1895. The prices of sheep also ruled a little higher than for several years.

The average weight of hogs sold at Chicago was 237 pounds; at Kansas City, 213 pounds; at Sioux City, 271 pounds; at Denver, 235 pounds.

Summary of receipts and shipments of farm animals at leading cities in 1899.

Stock center.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Chicago.....	Number.	Number.	Number.	Number.	Number.	Number.	Number.	Number.	Number.	Number.
Kansas City.....	2,514,446	811,874	133,676	18,187	8,177,870	1,089,439	3,682,832	388,901	111,011	100,040
Omaha.....	1,912,019	919,573	105,465	65,859	2,939,673	357,718	933,241	308,403	33,775	20,500
South St. Paul.....	837,563	288,474	.....	.....	2,306,482	25,969	1,080,323	342,747	34,253	20,192
Sioux City.....	160,886	134,402	51,479	37,717	369,243	54,950	383,508	308,924	4,870	3,532
St. Louis.....	115,074	67,739	.....	.....	300,280	51,309	15,411	5,405	348	.....
East St. Louis.....	46,539	6,028	7,232	.....	345,370	55,835	14,550	1,496	.....	.....
Indianapolis.....	684,062	177,749	.....	.....	1,801,038	514,378	408,984	92,712	119,485	92,816
St. Joseph.....	141,019	48,235	488	78	1,673,150	709,651	67,306	41,744	28,435	25,247
Milwaukee.....	286,257	66,053	8,713	6,182	1,401,794	122,945	238,383	79,239	9,232	8,017
Pittsburg.....	46,926	12,218	24,520	1,779	567,562	42,357	49,301	17,798	1,076	935
Lincoln.....	213,518	68,584	82,925	7,825	1,539,623	652,414	165,871	145,131	43,410	24,426
Cincinnati.....	77,321	76,072	.....	.....	25,702	4,477	108,412	157,058	15,925	10,925
Cleveland.....	175,024	38,773	35,046	559	931,381	394,517	138,716	199,710	.....	.....
Boston.....	28,314	383	2,844	23	482,649	522,365	100,439	2,133	.....	.....
Philadelphia.....	188,539	124,932	81,709	.....	1,631,855	.....	379,015	65,500	25,050	5,512
Baltimore.....	130,405	25,994	46,208	1,510	274,470	14,216	390,027	54,356	7,083	4,679
Buffalo.....	158,164	104,301	11,708	1,828	847,160	182,131	326,844	198,622	10,436	8,387
Louisville.....	534,842	467,622	22,200	15,100	4,972,320	4,040,100	1,447,000	1,392,400	62,040	60,040
Detroit.....	119,943	54,776	8,035	694	847,733	374,010	201,775	213,119	1,760	1,332
Jersey City.....	56,437	22,124	11,220	2,938	408,342	105,259	113,796	50,370	722	722
New York.....	128,636	107,032	44,915	37,016	574,000	.....	1,104,913	776,325	.....	.....
Wichawton.....	401,045	.....	297,759	.....	749,648	.....	713,675	.....	52,044	.....
Denver.....	27,583	282,012	43,226	.....	232,014	.....	139,836	.....	22,807	22,807
Pueblo.....	79,062	79,071	.....	.....	129,006	129,006	221,142	220,063	10,281	13,281
Fort Worth.....	106,526	94,000	.....	.....	25,214	25,214	78,796	78,796	5,379	5,379
Portland (Oregon).....	16,283	23,465	.....	.....	65,448	7,461	10,439	10,439	2,758	2,758
					28,605	10,485	60,045	40,110	5,679	4,899

San Francisco.....	34,614	5,689	83,793	148,818	453,502	25,645
Minnesota Transfer Rwy. Co.....	206,855	206,855	831	453,502	453,502	25,645
Total.....	9,721,577	4,308,431	197,335	13,343,559	5,600,431	466,522

Receipts and shipments of live stock at leading cities in 1899.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.
CHICAGO.										
January.....	191,564	54,061	7,000	623	784,513	79,404	334,140	33,123	10,422	9,158
February.....	172,956	58,738	6,191	536	606,197	109,528	275,309	23,242	10,401	9,479
March.....	207,311	75,742	10,503	529	722,229	227,622	315,179	42,880	16,967	14,219
April.....	174,655	62,640	15,479	1,858	537,534	161,256	275,985	39,936	11,963	10,761
May.....	226,741	82,363	23,413	3,428	740,834	177,331	324,370	32,352	11,210	9,366
June.....	305,122	74,426	16,362	1,451	760,924	154,716	247,016	23,423	6,643	6,362
July.....	208,414	61,055	11,667	1,075	695,966	156,729	238,138	18,568	4,906	4,274
August.....	227,134	79,828	12,338	1,304	544,182	136,201	328,906	37,512	8,724	7,642
September.....	217,294	71,685	9,282	2,394	555,871	139,011	342,382	49,408	11,067	9,508
October.....	233,906	76,034	9,401	2,540	606,596	118,623	350,764	52,251	8,266	7,507
November.....	223,594	64,506	8,643	2,021	756,628	79,353	314,278	24,457	6,730	6,289
December.....	207,775	52,776	6,387	548	746,416	89,665	316,295	9,839	5,593	5,476
Total.....	2,514,446	811,874	136,676	18,187	8,177,870	1,689,439	3,682,832	396,961	111,611	100,041
KANSAS CITY.										
January.....	136,410	61,404	2,076	1,050	322,999	18,376	69,487	12,606	1,716	1,063
February.....	116,821	58,840	2,025	1,064	258,389	11,553	70,876	12,663	1,653	1,190
March.....	126,752	62,813	3,470	2,365	245,523	19,239	73,859	13,039	2,184	1,359
April.....	109,472	49,257	2,495	1,415	251,200	28,661	110,730	38,148	1,475	1,066
May.....	115,656	43,855	2,170	588	318,366	31,200	76,776	18,397	1,514	1,050
June.....	86,160	28,278	3,998	852	303,944	45,047	67,635	32,660	913	677
July.....	110,470	40,823	8,335	1,057	179,021	19,278	66,353	21,668	823	664
August.....	220,162	106,898	11,762	3,515	171,562	30,319	89,166	40,766	1,982	1,330

Receipts and shipments of live stock at leading cities in 1899—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
KANSAS CITY—continued.										
September.....	259,834	156,294	18,274	9,180	106,881	19,598	87,957	39,280	1,545	1,041
October.....	273,520	133,507	25,711	18,805	245,476	17,078	89,347	34,079	7,174	3,700
November.....	208,762	108,315	15,604	14,879	275,350	10,421	58,026	21,850	5,815	3,824
December.....	141,892	70,319	9,455	10,089	220,312	10,989	63,938	22,408	6,082	3,487
Total.....	1,912,019	919,573	105,455	65,859	2,059,073	257,718	353,241	398,103	33,775	20,590
OMAHA.										
January.....	41,749	9,495	.....	.....	194,063	.....	81,974	10,388	667	502
February.....	43,554	11,073	.....	.....	131,074	.....	100,321	27,576	475	296
March.....	46,877	12,646	.....	.....	169,740	.....	132,051	52,633	579	273
April.....	50,332	12,185	.....	.....	166,554	808	109,479	32,306	602	381
May.....	68,334	8,282	.....	.....	220,488	2,503	72,073	20,854	780	670
June.....	55,480	6,853	.....	.....	291,778	4,769	37,857	3,308	1,772	1,655
July.....	51,141	10,032	.....	.....	200,319	11,329	48,226	18,331	5,127	4,750
August.....	86,442	30,741	.....	.....	153,539	3,540	89,949	25,704	6,307	4,040
September.....	120,066	60,027	.....	.....	149,573	2,378	131,809	55,032	7,505	7,247
October.....	128,673	65,606	.....	.....	162,176	611	135,841	63,116	6,022	4,735
November.....	90,680	40,383	.....	.....	206,249	.....	74,440	25,055	3,068	2,514
December.....	53,323	21,041	.....	.....	188,959	.....	46,040	7,744	1,162	1,193
Total.....	837,553	298,474	.....	.....	2,205,482	25,980	1,086,323	342,747	34,253	29,192
SOUTH ST. PAUL.										
January.....	7,907	5,228	2,020	731	40,228	1,285	50,726	25,852	79	61
February.....	6,920	5,871	2,420	1,249	25,247	961	42,363	25,019	83	37
March.....	8,018	6,960	4,902	3,002	35,472	1,058	22,087	31,583	130	121
April.....	5,036	4,583	2,788	2,011	29,708	1,840	9,116	20,022	11	9
May.....	6,945	5,601	4,074	2,673	41,236	8,255	2,302	47,896	37	30
June.....	6,911	4,707	3,055	2,365	31,225	4,303	3,183	11,310	66	64

July.....	6,294	3,183	1,625	1,004	23,503	1,835	11,559	5,149	233	115
August.....	19,009	13,029	3,405	2,950	19,733	1,791	14,059	10,017	1,725	1,143
September.....	29,065	24,631	6,635	5,881	18,221	2,007	56,794	18,235	1,397	1,070
October.....	38,580	33,581	9,088	6,944	35,057	3,256	99,808	41,285	31	19
November.....	23,484	19,437	7,170	6,221	39,825	6,154	57,059	48,108	969	670
December.....	10,377	6,621	3,062	2,306	39,236	2,205	12,481	26,459	393	204
Total.....	130,886	134,402	51,479	37,717	339,243	34,959	383,598	308,924	4,870	3,532
ST. LOUIS.										
January.....	8,835	5,428			18,185	8,072	1,613	1,003		
February.....	11,558	8,923			11,917	4,943	1,153	223	4	
March.....	12,501	8,262			15,024	1,471	940	223	29	
April.....	10,463	6,139			10,154	3,027	512			
May.....	8,299	5,396			10,624	3,319	704		92	
June.....	5,499	5,295			18,282	911	791			
July.....	3,145	1,010			14,565	2,439	272		147	
August.....	6,931	3,275			8,702	2,030	1,754	230	42	
September.....	10,580	6,508			13,437	339	1,646		1	
October.....	16,454	8,049			14,165	105	3,463	3,284	12	
November.....	13,648	5,435			28,739	5,625	1,250	303	21	
December.....	7,022	3,739			30,465	18,931	1,253	193		
Total.....	115,074	67,739			200,289	51,399	15,411	5,495	318	
ST. LOUIS.										
January.....	5,771	464	514		29,631	4,096	1,652	252		
February.....	4,485	382	513		23,713	4,014	1,284	363		
March.....	6,045	464			42,005	8,959	1,012			
April.....	5,316	595	944		33,712	6,639	990	178		
May.....	5,248	183	1,266		35,315	6,892	1,229	85		
June.....	2,742	142	579		27,184	5,432	1,399	134		
July.....	2,755	379			22,761	5,650	1,343	29		
August.....	2,416	461	411		24,756	6,451	1,611	108		
September.....	2,410	719	513		20,636	3,458	1,381			
October.....	3,183	936	416		27,895	996	1,001	13		

Receipts and shipments of live stock at leading cities in 1899—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.
ST. LOUIS—continued.										
November.....	3,345	632	480		30,904	2,039	882			
December.....	2,023	641	299		26,768	1,108	826	337		
Total.....	46,320	6,028	7,452		345,370	55,835	14,550	1,406		
EAST ST. LOUIS.										
January.....	58,322	15,350			230,031	55,058	25,047		13,484	11,013
February.....	57,937	13,508			150,777	44,452	27,634	2,446	11,823	9,261
March.....	56,354	12,229			108,089	53,703	17,412	508	13,575	11,121
April.....	37,635	8,542			150,095	54,031	17,142	1,178	6,761	5,705
May.....	34,325	6,006			159,585	46,848	51,002	8,831	6,989	4,725
June.....	36,510	6,680			149,942	41,973	62,589	22,623	3,328	2,280
July.....	48,440	9,403			114,391	34,062	63,002	27,807	4,370	3,059
August.....	70,012	19,705			112,830	42,380	38,656	11,025	8,835	6,653
September.....	89,012	30,395			106,310	33,762	35,835	7,288	8,322	6,146
October.....	83,848	24,916			123,233	40,382	23,506	3,459	15,659	10,856
November.....	62,080	18,060			156,960	29,359	23,060	2,906	14,085	11,825
December.....	47,708	12,716			168,244	34,478	18,589	1,731	12,564	10,472
Total.....	684,002	177,749			1,801,038	514,378	408,984	92,712	119,485	92,816
INDIANAPOLIS.										
January.....	11,861	4,365			108,210	75,144	2,123	451	2,303	2,075
February.....	8,155	1,990			99,213	53,391	1,703	890	2,042	2,263
March.....	10,083	3,018			106,379	50,813	1,101	187	3,798	3,581
April.....	7,423	1,896			103,217	48,307	1,298	515	2,827	2,641
May.....	7,786	1,394			132,058	40,106	6,156	2,408	3,063	2,415
June.....	11,450	3,897			167,457	61,949	11,204	9,280	1,639	1,305
July.....	11,001	3,004			149,691	67,030	10,005	7,384	1,084	890
August.....	13,677	3,969			118,494	70,024	12,134	7,741	2,566	2,206
September.....	13,137	3,447	35	8	106,778	46,694	6,831	4,694	2,667	1,905

October.....	15,435	7,110	82	83	152,306	57,566	5,477	3,488	2,569	2,265
November.....	14,577	6,140	159	28	187,510	83,587	4,922	2,033	2,511	2,145
December.....	13,064	7,171	232	9	195,437	97,521	3,340	1,943	1,565	1,397
Total.....	141,049	48,235	488	78	1,675,150	708,651	67,306	41,744	28,435	25,247
ST. JOSEPH.										
January.....	17,311	3,404	387	346	109,877	159	7,214	683	781	671
February.....	14,905	3,374	232	204	99,623	1,089	14,050	2,882	564	473
March.....	15,158	4,222	568	490	104,233	1,355	17,988	3,548	372	300
April.....	21,071	3,630	227	127	107,298	3,001	19,490	1,920	679	615
May.....	20,290	3,350	204	122	146,926	13,063	34,353	8,389	531	581
June.....	17,461	3,780	277	135	168,136	22,561	18,529	6,471	555	508
July.....	27,188	4,340	555	106	130,274	19,538	23,891	4,851	962	817
August.....	35,017	9,946	380	113	108,798	25,517	18,328	1,585	1,163	1,139
September.....	42,176	14,746	1,451	682	95,516	19,308	37,673	14,213	982	924
October.....	31,966	8,051	2,916	2,375	97,508	12,598	40,157	16,141	875	803
November.....	21,860	4,688	875	895	116,695	3,814	14,968	9,304	930	893
December.....	21,853	3,132	691	526	116,610	351	11,822	3,252	897	842
Total.....	286,237	66,653	8,713	6,182	1,401,794	122,945	258,363	73,239	9,252	8,617
MILWAUKEE.										
January.....	3,311	698	1,345	61	60,759	10,123	3,360	1,257	51	51
February.....	3,268	623	1,315	35	42,728	8,063	2,576	1,304	2	16
March.....	2,682	467	1,060	.....	39,971	5,435	1,215	123	138	103
April.....	3,344	644	3,101	315	37,694	293	1,555	231	104	69
May.....	3,407	578	2,735	232	35,479	6,342	1,463	359	99	66
June.....	3,948	793	3,066	139	62,169	7,483	3,532	838	147	121
July.....	3,973	963	2,619	519	30,032	1,500	4,279	965	34	30
August.....	3,250	917	2,118	77	25,683	147	3,624	861	15	73
September.....	5,350	1,427	1,896	89	36,896	339	5,586	1,488	223	210
October.....	3,388	1,160	1,253	136	57,815	1,341	6,800	2,380	144	120
November.....	5,471	2,115	1,294	96	64,753	1,397	11,219	7,962	109	75
December.....	5,554	1,833	1,428	80	73,551	.....	5,032	.....	10	1
Total.....	46,926	12,218	24,520	1,779	567,562	42,357	49,301	17,708	1,076	935

Receipts and shipments of live stock at leading cities in 1899—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
PITTSBURG.										
January	19,377	15,500	6,300	580	103,074	142,653	12,600	11,025	4,178	4,173
February	14,270	11,416	8,330	784	116,341	101,794	17,071	14,938	4,010	4,010
March	14,628	11,700	9,225	893	126,001	110,150	18,450	16,142	5,495	5,495
April	12,003	9,000	11,977	1,082	126,182	110,307	23,953	20,958	4,429	4,429
May	12,378	9,972	20,030	1,030	111,840	93,735	40,081	35,070	3,675	3,675
June	12,996	10,306	26,857	2,567	101,345	88,676	53,716	46,908	2,633	2,633
July	21,276	.....	.....	.....	98,745	.....	.....	.....	1,449	.....
August	22,675	.....	.....	.....	102,519	.....	.....	.....	4,270	.....
September	20,113	.....	.....	.....	115,100	.....	.....	.....	4,702	.....
October	32,632	.....	.....	.....	136,435	.....	.....	.....	3,333	.....
November	21,015	.....	.....	.....	153,512	.....	.....	.....	2,765	.....
December	20,155	.....	.....	.....	178,528	.....	.....	.....	2,206	.....
Total	213,518	68,584	82,925	7,825	1,529,023	652,414	105,871	145,131	43,416	24,426
LINCOLN.										
January	1,925	1,902	.....	.....	7,329	11	6,101	4,175	176	176
February	2,215	2,215	.....	.....	5,881	241	5,756	4,051	293	293
March	1,676	1,676	.....	.....	4,545	317	21,563	21,563	142	142
April	1,656	1,651	.....	.....	.....	.....	30,064	30,064	60	60
May	1,755	1,755	.....	.....	1,122	333	14,277	12,339	249	249
June	2,865	2,798	.....	.....	.....	.....	.....	.....	819	819
July	845	845	.....	.....	1,065	625	10,862	10,862	1,097	1,097
August	3,803	3,983	.....	.....	1,405	907	8,549	8,549	3,141	3,141
September	10,822	10,270	.....	.....	694	694	29,763	29,072	2,973	2,973
October	29,889	26,454	.....	.....	653	533	29,625	24,284	3,491	3,491

November.....	17,373	17,151	.....	731	731	8,429	5,923	1,730	1,730
December.....	5,497	5,412	.....	593	593	5,870	5,876	1,178	1,178
Total.....	77,321	76,072	.....	25,702	4,477	108,412	157,038	15,925	15,925
BALTIMORE.									
January.....	14,404	8,858	1,142	2	19,790	14,642	3,716	975	931
February.....	8,440	5,132	1,183	77	12,519	8,514	3,531	953	879
March.....	7,792	4,762	976	17	13,010	10,869	4,544	1,418	973
April.....	8,431	5,216	1,490	11	15,258	13,470	4,084	1,452	988
May.....	10,022	4,355	1,551	117	13,357	18,340	8,624	986	981
June.....	7,611	4,767	714	78	12,965	20,078	20,275	305	291
July.....	11,745	6,719	1,120	402	13,013	57,533	43,442	228	213
August.....	15,294	11,720	790	427	12,163	46,385	33,332	902	490
September.....	20,231	15,895	651	208	15,387	38,378	21,230	902	731
October.....	22,745	15,579	849	290	17,632	41,065	29,076	1,088	974
November.....	17,848	11,691	681	125	16,759	24,022	17,141	616	612
December.....	13,651	9,487	631	84	19,648	25,618	12,097	851	635
Total.....	158,164	104,201	11,708	1,868	182,131	323,844	198,692	10,436	8,387
BUFFALO.									
January.....	43,186	38,808	2,400	1,800	399,360	108,400	167,400	4,500	4,580
February.....	40,524	36,102	2,000	1,400	288,060	130,000	126,000	5,000	5,640
March.....	43,068	38,522	2,100	1,500	332,800	137,800	136,000	10,440	9,460
April.....	46,166	39,732	2,200	1,500	319,200	148,000	137,200	9,080	8,640
May.....	45,188	40,150	1,800	1,500	328,660	121,800	128,000	7,160	7,060
June.....	47,982	41,206	1,200	900	288,160	81,200	75,000	4,560	4,420
July.....	46,816	42,350	1,300	700	278,400	71,000	64,000	3,000	3,580
August.....	48,400	42,570	1,300	800	280,320	70,000	68,000	4,020	3,920
September.....	44,352	38,542	1,000	1,000	316,160	95,200	93,000	4,500	3,900
October.....	42,482	38,828	1,700	1,200	411,040	104,000	105,200	3,420	3,480
November.....	46,062	40,414	2,100	1,300	504,480	149,000	114,800	3,440	3,400
December.....	39,696	34,298	2,500	1,500	370,720	108,400	144,200	2,360	2,260
Total.....	534,842	467,522	22,200	15,100	4,040,160	1,447,000	1,362,400	62,680	60,940

Receipts and shipments of live stock at leading cities in 1899—Continued.

Stock yards at—	Cattle.			Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Number.	Receipts.	Number.	Receipts.	Number.	Receipts.	Number.	Receipts.	Number.
LOUISVILLE.											
January	13,373	7,051	83	612	98,482	47,480	1,043	2,030	392	1,043	238
February	9,906	3,784	22	563	74,346	34,464	490	1,101	118	490	112
March	7,875	2,878	38	680	72,911	30,903	513	1,362	87	513	65
April	6,394	2,754	31	663	71,318	32,700	1,183	2,362	203	1,183	177
May	7,475	2,241	10	901	67,882	36,804	11,043	16,578	120	11,043	91
June	6,654	2,750	29	747	55,185	12,107	81,045	89,798	81	81,045	50
July	8,304	3,212	63	744	51,488	15,410	78,172	47	47	78,172	23
August	9,046	4,413	86	662	45,766	11,677	36,743	41,449	120	36,743	81
September	11,689	6,062	78	665	53,010	20,795	12,049	17,342	75	12,049	53
October	16,674	7,337	40	682	86,634	44,002	1,044	3,670	180	1,044	100
November	13,117	7,510	83	576	85,693	46,065	873	2,535	197	873	153
December	9,723	4,754	122	534	85,115	44,958	744	1,888	194	744	117
Total	119,943	54,776	694	8,035	847,733	374,010	253,119	291,775	1,799	253,119	1,332
DETROIT.											
January	3,600	1,160	197	640	36,569	8,338	9,584	9,584	186	9,584	180
February	3,704	1,253	246	645	29,442	6,294	6,103	10,372	81	6,103	81
March	3,850	1,730	218	728	40,898	9,145	6,189	10,284	21	6,189	21
April	4,183	2,111	247	1,112	28,961	9,414	4,610	8,089	75	4,610	75
May	4,277	1,586	132	1,238	39,031	10,834	2,627	7,654	69	2,627	69
June	4,955	1,512	108	982	29,216	4,586	1,124	4,338	56	1,124	56
July	5,000	1,204	82	1,100	29,041	4,530	1,176	6,436	101	1,176	101
August	5,248	2,241	65	740	28,151	8,428	3,406	8,987	11	3,406	11
September	5,229	2,479	160	834	29,101	7,063	3,724	9,508	69	3,724	69
October	5,075	2,319	516	1,347	40,252	14,365	11,968	11,968	43	11,968	43
November	5,447	2,039	441	1,062	37,897	13,047	5,176	12,968	69	5,176	69
December	5,103	2,131	545	932	38,753	9,655	7,980	14,288	43	7,980	43
Total	56,467	22,174	2,939	11,230	408,348	105,890	60,676	113,760	729	60,676	729

CINCINNATI.									
January	14,532	2,572	2,068	33	100,638	42,083	6,737	1,700	
February	11,114	1,737	2,175	57	70,341	30,725	6,524	1,317	
March	12,102	1,320	3,307	14	77,611	28,072	5,520	925	
April	11,063	1,734	3,048	57	76,225	29,740	5,487	709	
May	15,549	2,020	4,004	51	81,603	28,028	11,848	4,423	
June	13,460	2,030	3,285	24	71,128	16,018	96,813	52,981	
July	13,189	2,700	2,708	19	64,515	23,291	75,804	65,077	
August	15,967	4,577	2,552	29	55,843	19,473	93,698	42,458	
September	17,531	5,037	2,455	64	61,784	22,023	24,809	13,367	
October	20,501	5,750	2,831	17	78,224	30,290	17,998	8,078	
November	16,867	4,611	2,200	70	90,610	31,300	12,114	4,748	
December	12,570	2,748	2,089	124	96,960	30,264	9,908	3,843	
Total	175,024	38,773	35,046	539	931,381	334,617	138,716	109,710	
CLEVELAND.									
January	2,338	40	155		98,162	57,591	7,040	437	
February	2,217		139		51,353	24,342	7,311	414	
March	2,753	138	305		54,006	23,063	9,374	36	
April	3,030		401		68,544	33,040	7,052		
May	3,213		338		80,585	37,337	6,910		
June	2,286	20	186	13	93,286	50,206	5,049		
July	2,184		193		64,934	30,130	6,375	99	
August	1,835		164		67,051	33,801	8,175		
September	1,105		182		75,800	43,314	10,238		
October	1,460	90	189	3	100,210	58,491	9,493	182	
November	2,774	20	334		114,020	69,986	10,727	241	
December	3,019	76	198	7	113,040	62,051	12,037	724	
Total	28,314	383	2,844	23	982,640	522,385	101,439	2,133	
BOSTON.									
January		6,027						12,183	419
February		8,888						13,109	278
March	41,317	11,981	4,544		438,946		112,470	14,153	1,008

Receipts and shipments of live stock at leading cities in 1899—Continued.

Stock yards at	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.
BOSTON, continued.										
April.....	.....	Number. 10,966	.....	Number. ....	.....	Number. ....	.....	Number. ....	.....	Number. 1,041
May.....	30,631	12,318	30,670	.....	428,766	.....	71,635	8,627	.....	429
June.....	.....	10,761	.....	.....	.....	.....	.....	8,108	.....	166
July.....	.....	12,071	.....	.....	.....	.....	.....	3,171	.....	247
August.....	49,815	12,535	24,269	.....	287,288	.....	91,967	.....	.....	403
September.....	.....	9,775	.....	.....	.....	.....	.....	.....	.....	283
October.....	.....	10,813	.....	.....	.....	.....	.....	1,061	.....	430
November.....	46,778	10,352	22,556	.....	372,885	.....	103,543	2,683	.....	409
December.....	.....	7,873	.....	.....	.....	.....	.....	3,797	.....	494
Total.....	188,539	124,932	81,799	.....	1,681,885	.....	379,615	65,500	625,050	5,512
PHILADELPHIA.										
January.....	11,583	1,347	3,064	3	29,954	3,405	32,525	2,086	424	345
February.....	9,120	1,825	2,808	77	21,029	1,384	22,897	1,982	534	376
March.....	9,512	2,312	3,542	167	20,998	1,794	23,772	1,982	1,181	765
April.....	10,507	1,894	4,345	56	19,501	1,111	25,173	2,254	862	690
May.....	13,875	2,814	6,708	288	22,324	172	37,557	6,217	898	658
June.....	9,886	2,117	4,681	70	18,809	210	29,543	5,467	602	387
July.....	12,322	2,919	4,173	333	20,402	525	38,319	7,172	251	206
August.....	10,450	2,735	3,808	188	16,472	651	29,543	6,119	525	107
September.....	10,030	1,653	4,074	145	21,302	449	31,831	3,909	680	313
October.....	12,452	3,285	3,609	216	28,164	1,231	42,206	3,758	385	213
November.....	10,011	1,101	2,988	73	27,163	1,946	38,471	6,085	495	217
December.....	10,718	2,000	2,425	.....	28,942	1,338	38,088	4,705	245	312
Total.....	130,445	25,994	46,208	1,510	374,470	14,216	380,027	51,393	7,083	4,679

JERSEY CITY.

January.....	10,800	8,840	2,554	2,267	52,120	90,610	62,220	.....	.....
February.....	7,040	5,231	4,080	3,749	47,060	80,800	63,844	.....	.....
March.....	12,020	10,117	6,850	4,878	52,072	86,012	64,018	.....	.....
April.....	11,100	9,335	8,980	6,140	40,280	93,840	74,357	.....	.....
May.....	9,240	8,407	8,920	3,509	47,024	92,005	70,109	.....	.....
June.....	12,194	11,005	8,300	4,603	42,250	95,500	69,273	.....	.....
July.....	12,400	10,671	6,480	3,873	49,353	97,700	69,457	.....	.....
August.....	11,485	9,607	5,536	3,101	45,790	99,012	70,036	.....	.....
September.....	12,724	10,768	4,520	2,608	43,783	97,520	61,047	.....	.....
October.....	10,532	8,753	3,600	1,450	49,618	94,800	60,863	.....	.....
November.....	9,660	7,448	2,400	409	50,980	85,314	49,833	.....	.....
December.....	9,320	7,700	1,536	330	53,620	83,700	61,740	.....	.....
Total.....	128,536	107,632	64,615	37,016	574,000	1,104,913	776,836	.....	.....

NEW YORK.

January.....	32,553	.....	7,954	.....	78,046	65,350	.....	4,282	.....
February.....	31,218	.....	9,763	.....	52,762	53,263	.....	4,954	.....
March.....	37,018	.....	22,543	.....	63,017	78,445	.....	6,069	.....
April.....	31,297	.....	30,956	.....	59,792	67,016	.....	5,934	.....
May.....	43,146	.....	32,003	.....	66,723	63,004	.....	5,125	.....
June.....	34,879	.....	39,511	.....	45,899	26,522	.....	3,845	.....
July.....	34,520	.....	24,108	.....	55,300	12,879	.....	2,370	.....
August.....	33,112	.....	25,970	.....	41,683	26,240	.....	3,257	.....
September.....	34,479	.....	24,843	.....	57,943	82,479	.....	3,504	.....
October.....	27,563	.....	15,633	.....	60,350	67,904	.....	4,371	.....
November.....	31,706	.....	15,066	.....	61,846	80,005	.....	4,233	.....
December.....	29,485	.....	19,319	.....	76,858	90,028	.....	3,570	.....
Total.....	401,045	.....	297,759	.....	719,648	713,675	.....	52,044	.....

WEEHAWKEN.

January.....	90	.....	1,333	.....	24,586	14,308	.....	1,720	1,720
February.....	61	.....	1,245	.....	18,397	14,187	.....	2,194	2,194
March.....	1,815	1,088	2,249	.....	18,861	14,357	1,083	2,997	2,997
April.....	2,416	2,311	4,796	.....	19,183	19,048	3,181	2,031	2,031

a The shipments of animals from Boston represent the exports.

Receipts and shipments of live stock at leading cities in 1899—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.
	Number.	Number.	Number.	Number.	Number.	Number.	Number.	Number.	Number.	Number.
WEEHAWKEN continued.										
May	3,182	2,922	8,107	.....	20,385	.....	12,706	4,049	1,476	1,476
June	2,257	1,956	4,891	.....	16,173	.....	6,353	2,425	1,853	1,853
July	3,416	2,877	5,923	.....	18,575	.....	863	.....	1,100	1,100
August	3,800	3,140	4,594	.....	16,470	.....	6,752	.....	1,896	1,896
September	3,334	2,648	2,575	.....	15,092	.....	12,134	.....	1,348	1,348
October	2,614	1,924	2,999	.....	20,910	.....	10,530	.....	1,641	1,641
November	2,483	1,959	2,299	.....	25,723	.....	12,147	1,013	2,380	2,380
December	2,065	1,868	2,215	.....	18,709	.....	16,861	.....	2,111	2,111
Total	27,583	.....	43,226	.....	232,004	.....	139,886	.....	22,807	22,807
DENVER.										
January	17,878	17,283	.....	.....	9,142	9,142	2,365	2,365	179	179
February	8,535	9,019	.....	.....	9,159	9,159	5,154	5,154	121	121
March	12,397	12,793	.....	.....	11,068	11,068	0,918	6,918	127	116
April	12,639	12,248	.....	.....	9,922	9,922	4,066	4,066	198	194
May	35,700	34,429	.....	.....	11,343	11,343	5,907	5,907	137	132
June	41,424	40,634	.....	.....	9,600	9,600	7,599	7,599	784	784
July	17,745	17,918	.....	.....	9,164	9,164	9,236	9,236	986	977
August	14,279	15,915	.....	.....	8,340	8,340	16,282	16,282	1,378	1,387
September	30,924	29,437	.....	.....	9,211	9,211	24,785	24,785	1,248	1,170
October	41,453	40,678	.....	.....	10,113	10,113	67,736	67,359	2,064	2,142
November	35,360	37,717	.....	.....	11,888	11,888	54,744	55,121	1,329	1,329
December	14,364	13,941	.....	.....	11,104	11,104	16,880	15,301	1,735	1,730
Total	282,928	282,012	.....	.....	120,006	120,006	221,142	220,063	10,286	10,281
PUEBLO.										
January	1,145	1,145	.....	.....	2,234	2,234	366	366	115	115
February	1,106	1,106	.....	.....	1,683	1,683	959	959	80	80

March	1,455	1,455	2,872	731	731	72	72
April	2,534	2,534	2,138	544	544	159	159
May	12,897	11,828	2,014			50	50
June	17,774	18,843	2,277	322	322	108	108
July	9,050	9,050	1,677	1,062	1,062	455	455
August	5,430	5,430	2,364	2,467	2,467	738	738
September	3,570	3,464	1,924	15,855	15,855	712	712
October	9,827	9,318	2,296	32,782	32,782	1,290	1,290
November	9,170	9,805	1,981	18,493	18,493	1,089	1,089
December	5,934	6,103	1,714	5,215	5,215	527	527
Total	79,982	79,971	25,214	78,786	78,786	5,379	5,379

January	2,092	1,463	1,463	325	325	244	244
February	1,664	1,013	3,169	224	174	141	141
March	4,272	3,047	4,832	161	94	167	167
April	14,248	14,241	3,405	2,427	49	201	201
May	18,413	17,390	10,148	190	144	16	16
June	7,768	7,078	7,186	2,401	2,878	139	139
July	3,776	2,753	2,204	4,323	4,303	94	94
August	4,341	3,446	3,444	324	313	472	472
September	5,123	4,203	7,631	315	304	288	288
October	14,129	13,168	8,530	1,710	1,470	290	290
November	19,715	17,793	7,081			540	540
December	10,007	9,200	6,407	716	701	196	196
Total	102,526	94,490	65,448	10,498	10,150	2,768	2,768

January	735	495	1,980	3,185	1,525	80	50
February	1,320	1,230	2,410	1,880	880	80	70
March		970	2,880	2,570	1,355	105	85
April	545	415	3,165	5,715	4,510	100	100
May	1,485	715	3,710	7,845	5,960	255	270
June	3,515	2,885	2,250	7,845	5,115	245	245
July	1,245	825	970	9,980	5,825	195	45

FORT WORTH.

PORTLAND, OREG.

Receipts and shipments of live stock at leading cities in 1899—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.	Receipts.	Ship-ments.
PORTLAND, OREG.—continued.										
August.....	2,510	1,835	.....	.....	1,245	1,040	5,365	4,365	950	500
September.....	940	495	.....	.....	1,060	715	6,200	6,200	665	220
October.....	825	1,120	.....	.....	2,270	605	3,325	1,040	1,370	80
November.....	1,270	840	.....	.....	2,425	485	2,065	1,080	865	260
December.....	900	550	.....	.....	3,760	1,765	3,540	1,245	185	125
Total.....	16,220	12,465	.....	.....	23,665	16,465	60,015	40,110	5,270	1,860
SAN FRANCISCO.										
January.....	2,720	.....	332	.....	4,005	.....	10,222	.....	.....	.....
February.....	3,053	.....	272	.....	2,931	.....	9,738	.....	.....	.....
March.....	2,713	.....	179	.....	3,275	.....	12,022	.....	.....	.....
April.....	2,070	.....	30	.....	2,077	.....	9,068	.....	.....	.....
May.....	3,207	.....	08	.....	2,700	.....	15,818	.....	.....	.....
June.....	2,345	.....	254	.....	1,489	.....	11,708	.....	.....	.....
July.....	2,021	.....	174	.....	1,610	.....	13,146	.....	.....	.....
August.....	2,801	.....	278	.....	2,647	.....	16,659	.....	.....	.....
September.....	2,771	.....	281	.....	1,068	.....	12,517	.....	.....	.....
October.....	2,663	.....	163	.....	3,578	.....	12,789	.....	.....	.....
November.....	3,071	.....	288	.....	4,103	.....	14,461	.....	.....	.....
December.....	2,380	.....	233	.....	3,229	.....	10,800	.....	.....	.....
Total.....	34,614	.....	5,669	.....	33,793	.....	146,618	.....	.....	.....
MINNESOTA TRANSFER RAILWAY COMPANY.										
1899.										
January.....	1,849	1,840	.....	.....	8,365	8,365	79,069	79,069	918	918
February.....	2,025	2,025	.....	.....	6,540	6,540	63,437	63,437	2,604	2,604
March.....	3,293	3,293	.....	.....	5,525	5,525	30,503	30,503	6,896	6,896
April.....	4,500	4,500	.....	.....	6,961	6,961	6,190	6,190	4,127	4,127

May.....	2,063	2,063	7,210	2,654	1,702	1,702	1,702
June.....	3,330	3,330	4,338	8,378	1,971	1,971	1,971
July.....	4,602	4,602	3,524	1,844	2,190	2,190	2,190
August.....	57,029	57,029	1,818	51,096	4,370	4,370	4,370
September.....	94,821	94,821	392	104,232	1,862	1,862	1,862
October.....	71,411	71,411	85	204,042	1,769	1,769	1,769
November.....	21,029	21,029	157	82,781	1,041	1,041	1,041
December.....	1,854	1,854	106	29,062	1,183	1,183	1,183
Total.....	298,734	298,734	44,053	645,306	29,633	29,633	29,633
1839.							
January.....	630	630	261	65,041	646	646	646
February.....	757	757	0	44,828	1,520	1,520	1,520
March.....	950	950	40	20,658	3,166	3,166	3,166
April.....	1,610	1,610	3	5,745	2,028	2,028	2,028
May.....	2,103	2,103	0	0	732	732	732
June.....	597	597	63	350	1,063	1,063	1,063
July.....	263	263	152	12,900	2,055	2,055	2,055
August.....	29,515	29,515	160	35,147	3,841	3,841	3,841
September.....	78,935	78,935	19	47,295	3,805	3,805	3,805
October.....	69,538	69,538	28	149,352	3,644	3,644	3,644
November.....	22,769	22,769	45	35,862	1,971	1,971	1,971
December.....	1,188	1,188	60	36,296	1,344	1,344	1,344
Total.....	298,855	298,855	831	453,542	25,645	25,645	25,645

Range or average price of live stock at Chicago, 1892.

CATTLE.

Month and year.	Native steers, 1,500-1,800 pounds.		Native steers, 1,200-1,500 pounds.		Poor to choice cows and heifers.		Native stockers and feeders.		Straight Texans and Westerns	
January	\$4.90 to \$6.20		\$4.10 to \$6.30		\$2.00 to \$5.00		\$2.75 to \$4.82		\$3.25 to \$5	
February	4.75	6.25	4.20	6.20	2.00	5.25	3.20	4.75	3.50	5.
March	4.70	5.85	4.00	5.90	2.00	5.15	3.10	5.35	3.50	6.
April	4.60	5.75	4.10	5.85	2.00	5.25	3.70	5.15	3.65	5.
May	4.85	5.70	4.30	5.75	2.10	5.10	3.50	5.40	3.90	5.
June	4.95	5.65	4.55	5.75	2.25	5.50	3.50	5.20	3.65	5.
July	5.30	6.00	4.70	5.95	2.20	5.40	3.15	5.10	3.25	5.
August	5.45	6.65	4.60	6.60	2.00	5.85	3.00	4.90	3.25	5.
September	5.60	6.90	4.70	6.85	2.10	5.35	2.75	5.00	3.10	5.
October	5.35	7.00	4.50	7.00	2.05	6.00	2.50	4.90	3.25	5.
November	5.10	7.15	4.10	7.00	2.25	5.25	2.50	4.75	3.25	6.
December	5.60	8.25	4.20	8.25	2.00	6.85	2.50	4.90	3.65	5.
Range:										
1899	4.00	8.50	4.00	8.25	2.00	6.85	2.50	5.40	3.10	6.
1898	4.10	6.25	3.80	6.15	2.00	5.40	2.50	5.40	3.15	5.
1897	4.00	6.00	3.35	6.00	1.75	5.40	2.40	4.75	2.75	4.5
1896	3.40	6.50	2.90	6.25	1.75	4.50	2.20	4.10	2.10	5.
1895	3.60	6.60	2.90	6.40	2.00	5.75	2.25	5.15	2.25	5.
1894	3.00	6.60	2.90	6.00	1.75	4.40	2.00	4.15	2.50	5.
1893	4.00	6.75	2.90	6.50	2.00	5.00	2.25	4.90	2.50	6.
1892	3.75	7.00	2.85	6.35	1.85	4.00	2.00	4.10	1.50	5.2

a Two carloads sold at \$8.25 and three head at \$8.50.

HOGS.

Month and year.	Heavy pack- ing, 250-500 pounds.		Mixed pack- ing, 200-250 pounds.		Light bacon, 150-200 pounds	
January	\$3.35 to \$4.05		\$3.40 to \$4.00		\$3.20 to \$4.02	
February	3.45	4.05	3.45	4.02	3.40	4.02
March	3.50	4.00	3.50	3.95	3.50	4.00
April	3.50	4.15	3.60	4.10	3.55	4.05
May	3.45	4.05	3.55	3.95	3.55	4.05
June	3.40	3.95	3.55	3.92	3.50	4.00
July	3.55	4.05	3.70	4.70	3.75	4.70
August	3.85	4.95	4.10	5.60	4.25	5.60
September	3.90	4.77	4.15	4.85	4.20	4.80
October	3.80	4.75	4.05	4.82	4.00	4.80
November	3.55	4.35	3.65	4.35	3.65	4.35
December	3.65	4.45	3.75	4.42	3.75	4.40
Range:						
1899	3.35	4.95	3.40	5.00	3.40	5.00
1898	3.10	4.80	3.10	4.70	3.10	4.65
1897	3.00	4.45	3.20	4.50	3.20	4.45
1896	3.40	4.45	2.75	4.45	2.80	4.45
1895	3.20	5.45	3.25	5.55	3.25	5.70
1894	3.90	6.75	3.90	6.55	3.50	6.45
1893	3.80	8.75	4.25	8.65	4.40	8.50
1892	3.70	7.90	3.60	6.85	3.60	6.85

Range or average price of live stock at Chicago, 1899—Continued.

SHEEP.

Month and year.	Native sheep, 80-140 pounds.		Native year- lings and lambs.		Western sheep, 70-140 pounds.		Western and Mexican lambs.	
January	\$2.50 to \$4.50		\$3.75 to \$5.35		\$3.00 to \$4.40		\$4.00 to \$5.15	
February	2.50	4.75	3.75	5.10	3.00	4.60	4.50	5.10
March	2.75	5.10	3.75	5.60	3.40	5.05	4.60	6.00
April	3.00	5.15	4.00	6.05	4.00	5.10	4.75	6.15
May	3.50	5.65	4.00	6.60	4.00	5.55	5.25	7.00
June	2.75	5.50	3.75	7.45	3.50	5.15	4.75	7.00
July	2.50	5.40	3.50	7.10	3.50	5.00	4.50	6.75
August	2.25	5.00	3.50	7.00	3.25	4.30	4.50	6.50
September	2.25	4.60	3.50	6.50	3.25	4.50	4.50	5.60
October	2.50	4.60	3.50	6.00	2.75	4.50	4.40	5.00
November	2.50	4.75	3.50	5.75	2.50	4.55	4.50	5.85
December	2.50	4.75	3.50	6.00	2.75	4.75	4.65	5.90
Range:								
1899	2.25	5.65	3.50	7.45	2.50	5.55	4.00	7.00
1898	2.00	5.25	3.50	7.10	3.00	5.25	3.75	6.75
1897	1.25	5.25	3.00	6.40	2.15	5.35	3.50	6.25
1896	1.00	4.60	2.75	6.60	2.15	4.30	3.50	6.25
1895	1.25	5.50	2.25	6.35	2.50	5.35	3.00	6.00
1894	1.00	5.40	2.00	6.00	2.00	5.40	2.50	5.80
1893	1.50	6.25	2.25	7.55	2.50	6.45	2.25	6.75
1892	2.25	6.90	3.00	8.25	3.00	6.75	3.50	7.25

HORSES.

Month.	Draft horses.	Carrriage teams.	Drivers.	General use.	Bussers and tram- mers.	Sad- dlers.	Southern horses.
January	\$135	\$390	\$120	\$100	\$112.50	\$130	\$50.00
February	150	410	130	105	115.00	140	50.00
March	155	410	135	105	117.50	145	55.00
April	160	450	145	110	120.00	150	57.50
May	150	440	150	105	120.00	175	52.50
June	142	420	145	110	117.50	165	50.00
July	145	410	140	108	115.00	165	47.50
August	152	400	140	105	112.50	155	45.00
September	158	400	135	100	110.00	155	47.50
October	160	390	135	95	110.00	145	50.00
November	160	385	130	90	112.50	140	47.50
December	155	385	130	90	115.00	135	47.50

RULES AND REGULATIONS OF THE BUREAU OF ANIMAL INDUSTRY ISSUED IN 1899.

[B. A. I. Order No. 30. Additional to B. A. I. Order No. 23.]

SPECIAL ORDER PLACING CERTAIN COUNTIES IN TEXAS IN QUARANTINE.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 9, 1899.

In consequence of the regulations of the State of Texas and the establishment of a quarantine upon certain counties hereinafter named by the duly constituted authorities of that State—

It is hereby ordered. That no cattle be removed from the counties of Wilbarger, Foard, Knox, Haskell, Jones, Fisher, Mitchell, Sterling, West Tom Green, Irion, Upton, and Crane, in the State of Texas, to, or be allowed to pass through, any uninfected area except in the manner prescribed by the regulations concerning cattle transportation (B. A. I. Order No. 24) issued by this Department December 19, 1898, unless satisfactory evidence is given that they are not affected with splenic, or Texas, fever, and have not been exposed to the contagion thereof, in which case a special permit for such movement may be issued by the inspector of the Bureau of Animal Industry or by the Texas Live Stock Sanitary Commission.

This order will remain in force for the period beginning on this date and ending November 1, 1899, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 31. Amendment to B. A. I. Order No. 24.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

FEEDING STATIONS AT FORT WORTH, TEX., AND SALISBURY, N. C.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 9, 1899.

It is hereby ordered. That cattle originating outside, north and west, of the quarantine line as defined in Bureau of Animal Industry Order No. 24 (December 19, 1898), or amendments thereto, and which are to be transported by rail through the quarantined district, may be unloaded for rest, feed, and water into noninfected pens set apart for such cattle at Union Stock Yards, Fort Worth, Texas, and at Salisbury, North Carolina, providing the cattle are free from Southern cattle ticks and have not been unloaded at any other place within the quarantined district. They may, after unloading into said pens, be reloaded into the same cars from which unloaded, or into other cleaned and disinfected cars, and reshipped as uninfected cattle.

All prior orders conflicting herewith are hereby revoked.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 32. Amendment to B. A. I. Order No. 24.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

MOVING CATTLE FROM TWO NORTHERN TIERS OF COUNTIES IN ARKANSAS INTO MISSOURI.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., March 8, 1899.

Conforming to the State regulations of Missouri, it is hereby ordered that B. A. I. Order No. 24 be amended so as to permit the entry of cattle for purposes other than immediate slaughter, from the two northern tiers of counties in the State of Arkansas into the State of Missouri: *Provided*, That said cattle have remained in the above-described counties since January 1 of this year and have been jointly inspected by officers of the Bureau of Animal Industry of this Department and of the State of Missouri and found to be free of splenetic, or Texas, fever and not to have been exposed to the contagion thereof; that proper facilities shall have been afforded for making such inspection, and that after inspection the cattle shall be moved without delay and without exposure to the infection of splenetic, or Texas, fever into the State of Missouri.

Provided further, That written permission to move said cattle must be obtained from the officials mentioned, and said permission will be granted only for cattle which are to remain within the State of Missouri for three months thereafter.

This order to remain in force until otherwise ordered.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 33.]

RULES AND REGULATIONS FOR THE INSPECTION OF LIVE STOCK AND THEIR PRODUCTS.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., March 15, 1899.

The following rules and regulations are hereby prescribed for the inspection of live cattle, sheep, hogs, horses, and their carcasses by virtue of the authority conferred upon the Secretary of Agriculture under the provisions of the act of Congress approved March 2, 1891, entitled "An act to provide for the inspection of live cattle, hogs, and the carcasses and products thereof which are the subjects of interstate commerce, and for other purposes," and amendments thereto, approved March 2, 1895, and March 22, 1898, and will supersede all former regulations for the inspection of live stock and their products:

1. Proprietors of slaughterhouses, canning, salting, packing, or rendering establishments engaged in the slaughtering or packing of cattle, sheep, swine, or horses, the carcasses or products of which are to become subjects of interstate or foreign commerce, shall make application to the Secretary of Agriculture for inspection of said animals and their products.

2. The said application must be made in writing, addressed to the Secretary of Agriculture, Washington, D. C., and shall state the location and address of the slaughterhouse or other establishment, the kind of animals slaughtered, the estimated number of animals slaughtered per week, and the character and quantity of the products to go into local, interstate, or foreign commerce from said establishment; and the said applicant in his application shall agree to conform strictly with all lawful regulations, orders, and instructions that may be made by the Secretary of Agriculture and Chief of the Bureau of Animal Industry for carrying on the work of inspection at such establishment.

3. The Secretary of Agriculture will give said establishment an official number by which all its inspected products shall thereafter be known, and this number shall be used both by the inspectors of the Department of Agriculture and by the owners of said establishment to mark the products of the establishment as herein-after prescribed.

4. The Secretary of Agriculture will designate an inspector to take charge of the examination and inspection of animals and their products at each establishment which has been officially numbered, and will detail to such inspector, assist-

ant inspectors, or other employees as may be necessary properly to carry on the work of inspection at said establishment. The inspector and all employees under his direction shall have full and free access to all parts of the building or buildings used in the slaughter of animals and the conversion of their carcasses into food products.

(a) This Department assumes the right to inspect all animals slaughtered in establishments that have been granted inspection, and no carcasses or meat products which have not been inspected and passed by an officer of this Department shall be allowed to enter such establishment.

(b) The managers of abattoirs will inform the inspector in charge or his assistant of the hour upon which slaughtering will commence upon the day following. The inspector or his assistant shall also be informed by the manager when slaughtering has been concluded for the day, and no animal shall be slaughtered at any other hours unless the inspector or his assistant is duly notified.

(c) Each employee engaged in inspection under these regulations will be furnished with a numbered badge, which must be worn in a conspicuous manner while in the performance of his official duties and which must not be allowed to leave his possession.

(d) Each employee furnished with a badge must deposit with the inspector in charge a receipt for the said badge and the sum of \$2, which amount must be transmitted by New York draft (without expense to the Department), together with the said receipt, to the Chief of Bureau of Animal Industry, and to be duly receipted for by the Disbursing Clerk of the Department, who will be the custodian of this guarantee fund. On return of this receipt and badge by the employee at the expiration of his service, the deposit shall be immediately refunded to him.

5. An antemortem examination shall be made of all animals arriving at the stock yards and intended for slaughter at abattoirs at which this Department has established inspection when said animals are weighed, or, if not weighed, this inspection shall be made in the pens. Any animals found to be diseased or unfit for human food shall be marked by placing in the ear a metal tag bearing "U. S. Condemned" and a serial number. Such condemned animals shall at once be removed by the owners from the pens containing animals which have been inspected and found to be free from disease and fit for human food, and must be disposed of in accordance with the laws, ordinances, and regulations of the State and municipality in which said condemned animals are located.

Animals condemned on account of their pregnant or parturient condition shall not be slaughtered during gestation nor for ten days thereafter. They may, however, be removed by permit for stock and dairying purposes (except when they are affected with or have been exposed to the contagion of any disease) or for rendering into grease.

6. When animals are not inspected in the stock yards, the inspector in charge of an establishment, or his assistant, shall carefully inspect all animals in the pens of said establishment about to be slaughtered, and no animal shall be allowed to pass to the slaughtering room until it has been so inspected. All animals found on either antemortem or postmortem examination to be affected as follows are to be condemned and the carcasses thereof treated as indicated in section 7:

- (1) Hog cholera.
- (2) Swine plague.
- (3) Charbon, or anthrax.
- (4) Rabies.
- (5) Malignant epizootic catarrh.
- (6) Pyemia and septicemia.
- (7) Mange or scab in advanced stages.
- (8) Advanced stages of actinomycosis, or lumpy jaw.
- (9) Inflammation of the lungs, the intestines, or the peritoneum.
- (10) Texas fever.
- (11) Extensive or generalized tuberculosis.
- (12) Animals in an advanced state of pregnancy or which have recently given birth to young.

(13) Any disease or injury causing elevation of temperature or affecting the system of the animal to a degree which would make the flesh unfit for human food.

Any organ or part of a carcass which is badly soiled or affected by tuberculosis, actinomycosis, cancer, abscess, suppurating sore, or tapeworm cysts must be condemned.

- (14) Animals too young and immature to produce wholesome meat.
- (15) Animals too emaciated and anemic to produce wholesome meat.

(16) Distemper, glanders and farcy, and other malignant disorders, acute inflammatory lameness, and extensive fistula.

7. The inspector or his assistant shall carefully inspect at the time of slaughter all animals slaughtered at said establishment and make a postmortem report of the same to the Department. The head, tail, caul, or fat inclosed in the omentum of the animal, and all other portions of which are to be used as food product, shall be retained in such manner as to preserve their identity until after the postmortem inspection has been completed, in order that it may be identified in case of condemnation of the carcass. Should the carcass of any animal on said postmortem examination be found to be diseased or otherwise unfit for human food, the said carcass shall be marked with the yellow condemnation tag, to be attached with wire and seal, and the diseased organ or parts thereof, if removed from said carcass, shall be immediately marked with the coupon of the same tag. All unborn calves must be placed in the rendering tank under the inspector's supervision.

All abattoirs at which inspection is established shall provide a suitable room in which condemned carcasses and parts can be held until such a time as the inspector or his assistant can supervise the tanking thereof. Such room shall be arranged for locking with a padlock which will be furnished by this Department, the key to the same to remain in the possession of the inspector or his assistant. The tanking of carcasses and parts will be conducted as follows:

After the lower opening of the tank has been sealed, the condemned portions shall be placed in the offal tank in the morning, and immediately a sufficient force of steam be turned into the tank to destroy effectually the meat for food purposes before the killing for the day is complete; or place the condemned portions in the offal tank at the close of the day, or when killing is suspended, and seal both ends of the tank, after which steam shall be turned into the tank until the meat is destroyed; or slash the meat thoroughly with a knife, and then saturate all parts with kerosene and place the portions in the tank. Copper wire and lead seals will be provided by the Department for sealing tanks.

Should the establishment have no facilities for thus destroying the said carcass, it must be removed from the premises by numbered permit from the inspector to rendering works designated by him, and there destroyed under his supervision in the manner described above.

(a) Carcasses may be taken to the cooling rooms after marking with the yellow condemnation tag, in cases where only a portion of the carcass is condemned, and when such portion can not be removed without damage to the carcass until it is properly chilled. After chilling, the condemned portions must be cut out and removed to the tank or to the condemned meat room, as provided for whole carcasses. Condemned parts that can be removed without damage to the carcass must be tanked as described above.

(b) All condemned carcasses and parts must only be disposed of in the presence of an employee of this department, and the report of the disposition shall be made by him upon the proper form provided therefor. Condemned tags used to mark the carcasses and parts must not be removed, but must accompany the meat into the tank.

(c) Should the owners of such condemned carcasses not consent to the foregoing disposition of them, then the inspectors are directed to attach to carcasses or parts a condemned tag by means of a wire and lead seal. This seal shall have the word "Condemned" impressed upon the one side and the letters "U. S. A." upon the reverse side, also brand the word "Condemned" upon each side and quarter or piece of said carcass, and a record kept of the kind and weight of the carcasses, and they shall, under supervision of the inspector or his assistant, be removed from the abattoir; and said firm or corporation shall forward, through the inspector, to the Secretary of Agriculture, a sworn statement monthly giving in detail the disposition of the carcasses so condemned and, if the same have been sold, showing to whom, whether for consumption as food or otherwise, with what knowledge, if any, by the purchasers, of their condemnation by this department, and whether or not before such sale said carcasses have been cooked or their condition at the time of inspection by this department altered, and, if so, in what way.

The inspectors shall, when authorized by the Secretary of Agriculture, give notice by publication to the express companies and common carriers at the place of condemnation of the fact of condemnation, giving the name of the owner of such carcasses or parts, the time and place of slaughter, the reason for rejection, and a description of the carcasses or parts, and warning them not to transport them out of the State.

8. All persons are warned against removing the tags, seals, or brands so attached to condemned carcasses or parts, and are notified that they will be prosecuted under the act of Congress of March 3, 1891, and March 2, 1895, for any such

attempt to tamper with the device for marking condemned carcasses or parts of carcasses as prescribed by the preceding regulation.

9. Carcasses or parts of carcasses which leave said establishment for local, interstate, or export trade will be marked by the inspector, or an employee designated by him, with a numbered tag or a branding stamp, issued by the Department of Agriculture for this purpose, and a record of the same will be sent to the Department at Washington.

(a) Carcasses or parts of carcasses which go into the cutting room of an abattoir or are used for canning purposes must not be tagged. Those which are to be shipped from one abattoir to another for canning or other purposes must not be tagged; and the inspector in charge of the abattoir to which the shipment is consigned, in cars sealed and tagged on both sides, must be notified of the said shipment, including the number and initials of the said cars and the routes traversed by them. Cars which contain other than inspected meat must not be sealed.

Managers of abattoirs must give due notice to the inspector or his assistant of all intended shipments and of all expected receipts of meat in cars, if the meat is received to be taken into an abattoir having inspection, and the seal upon said cars shall not be broken except in the presence of an inspector.

No meat or meat products shall be received at an official establishment unless the inspector or his assistant has full knowledge concerning the same.

10. Each article of food product, whether in cans, barrels, firkins, kits, boxes, or canvas, made from inspected carcasses, must bear a label containing the official number of the establishment from which said product came, and also contain a statement that the same has been inspected under the provisions of the act pertaining thereto.

(a) A copy of said label must be filed at the Department of Agriculture, Washington, D. C., and after filing, said label will become the mark of identification showing that the products to which it has been attached have been inspected, as provided by these rules and regulations; and any person who shall forge, counterfeit, alter, or deface said label will be prosecuted under the penalty clause of section 4 of the act of March 3, 1891, as amended in the act of March 2, 1895.

(b) All packages, such as barrels, boxes, firkins, kegs, etc., to be shipped from the said establishment to any foreign country must have printed or stenciled on the side or on the top by the packer or exporter the following:

FOR EXPORT.

- (a) Official number of establishment.
- (b) Number of pieces or pounds.
- (c) Shipping marks.
- (d) Inspected according to act of Congress¹

In case said package is for transportation to some other State or Territory, or to the District of Columbia, in place of the words "For export," the words "Interstate trade" shall be substituted.

(c) The letters and figures in the above print shall be of the following dimensions: The letters in the words "For export" or the words "Interstate trade" shall not be less than three-fourths of an inch in length and the other letters and figures not less than one-half inch in length. On packages too small to contain the words of the dimensions given, smaller letters may be used. The letters and figures affixed to said package shall be black and legible, and shall be in such proportion as the inspector of the Department of Agriculture may designate.

11. The inspector of the Department of Agriculture in charge of said establishment, being satisfied that the articles in said packages came from inspected animals, and that they are wholesome, sound, and fit for human food, shall cause to be pasted upon said packages meat-inspection stamps bearing serial numbers.

12. In order that the stamps may be protected, and to insure uniformity in affixing, inspectors will require of the proprietors of abattoirs and packing establishments the adoption of cases suitable for one of the two methods mentioned below:

(a) The stamp may be affixed in a grooved space let into the box, of sufficient size to admit it, similar to that required by the Internal Revenue Bureau for the stamping of packages of plug tobacco.

(b) Stamps may be placed on either end of the package, provided that the sides are made to project at least one-eighth of an inch, to afford the necessary protection from abrasion.

13. The stamp having been affixed, it must be immediately canceled. For this purpose the inspector will use a rubber stamp having five parallel waved lines.

¹ In the blank space following the word "Congress" the date of the act under which the inspection is made shall be inserted.

At the top of said rubber stamp shall be the name of the inspector and at the bottom the abattoir number. The imprinting from this rubber stamp must be with durable ink over and across the stamp and in such a manner as not to make the reading matter illegible. The stamp having been affixed and canceled, it must be immediately covered with a coating of transparent varnish or other similar substance. Orders for inspection stamps and for rubber canceling stamps must be made by the inspector on the Chief of the Bureau of Animal Industry.

14. No stamps, tags, seals, etc., will be issued by the inspector except to employees of this Department designated by him to supervise the affixing of said stamps, etc., to inspected products, and each employee having charge of this work shall be held personally responsible for the stamps, tags, seals, presses, etc., issued to him, and shall make an accurate daily report to the inspector of the use of such stamps, etc., and all unused articles shall be turned over to the custody of the said inspector or of his clerk at the close of each day's work.

(a) Proprietors of abattoirs will supply all the necessary help to affix the stamps, which must be done under the supervision of an employee of this Department.

(b) No stamps, tags, etc., shall be allowed to remain loose about the office or the abattoirs, and inspectors are instructed to use such additional safeguards as in their judgment will be necessary properly to account for every stamp, tag, etc., issued by them, and to have the work of affixing so carefully supervised that nothing but inspected products will be so marked.

(c) Any stamps, tags, or seals damaged or not used should not appear upon the reports as having been affixed to inspected articles, but should be returned to the inspector in charge and a report made as to the reasons for their return.

Certificates of inspection which are not used or otherwise rendered useless must be returned to the Department at Washington.

15. Whenever any package of meat products bearing the inspection stamp shall have been opened and its contents removed for sale, the stamp on said package must be obliterated. Tags removed from inspected carcasses and parts must be destroyed.

16. Reports of the work of inspection carried on in every establishment shall be daily forwarded to the Department by the inspector in charge on such blank forms and in such manner as will be specified by the Chief of the Bureau of Animal Industry.

17. Whenever an abattoir suspends slaughtering operations the inspector in charge will promptly furlough without pay, until further orders, all employees whose duties are affected by such suspension, notifying this office of the same. During said suspension he will retain only such employees as are actually necessary to supervise the shipments of inspected products from said abattoir.

18. The inspector in charge of the slaughtering or other establishment will issue a certificate of inspection for all carcasses of animals or the food products thereof which are to be exported to foreign countries, which certificate will cite the name of the shipper, the date upon which the stamps were affixed to packages, or tags to cars, the name of the consignee, and destination. Packages should not be stamped until they are ready for shipment. Said certificate will also contain the numbers of the stamps or tags attached to the articles to be exported, and the shipping marks, and will be issued in serial numbers and in triplicate form. One certificate only will be issued for each consignment, unless otherwise directed by the Chief of the Bureau of Animal Industry.

Both the original and duplicate certificates must be delivered to the exporter. The original is to be attached by him to the bill of lading accompanying the shipment for the information of the customs authorities, and should be delivered to the chief officer of the vessel upon which said consignment is to be transported and continue with the shipment to destination. The duplicate should be forwarded by the consignor to the consignee, to be used by the latter in identifying the shipment at the port of destination by comparison with the original.

(a) All names, marks, stamp numbers, imprints, and other writing of any description made upon the certificate of inspection must be copied on the stub of the book of certificates and be duly signed by the inspector. This stub constitutes the third copy of the certificate, and shall be preserved and forwarded to this Department.

19. All packages, such as cans, barrels, boxes, kits, firkins, etc., containing inspected horse meat must be so marked as to indicate the species of animal from which made. Special stamps and certificates shall be used in marking and in certifying to inspected horse meat. No other animals are to be slaughtered or certified to in an establishment engaged in the slaughter or packing of horse flesh.

MICROSCOPIC.

20. A microscopic examination for trichinæ must be made of all swine products exported to countries requiring such examination.

(a) No microscopic examination will be made of hogs slaughtered for interstate trade, but this examination will be confined to those intended for the export trade, and only at abattoirs which export pork products to countries requiring a certificate from this Government to secure the admission of such meats. All inspectors issuing certificates for export of swine products which have been microscopically examined will enter upon the same the number of each stamp used, also the name of the consignor, consignee, destination, and description of article.

(b) The purple meat-inspection stamp and certificate will be used only for packages containing products of hog carcasses which have been microscopically examined for shipment to countries requiring such examination.

All stamps upon packages containing microscopically inspected meat must be placed in grooved spaces as provided by paragraph (a), section 12, and covered with tin. Stamps upon barrels need not be placed in grooved spaces, providing tins having raised centers, one-eighth of an inch high, the size of stamps, are used. The tins placed over stamps must be sufficiently large to go over the whole.

All stamps upon other packages shall be arranged as provided by section 12.

21. The microscopic inspection of pork intended for export to countries requiring such inspection shall be conducted as follows:

When the slaughtered hog is passed into the cooling room of said establishment, the inspector in charge, or his assistants, will take from each carcass three samples of muscle—one from the "pillar of the diaphragm," one from the psoas muscle, and the other from the inner aspect of the shoulder, and also from the base of the tongue when that organ is retained for exportation; and said samples will be placed in small tin boxes, and a numbered tag will be placed upon the carcass from which said samples have been taken, and a duplicate of said tag will be placed in the box with said samples. The small boxes will be placed in a large tin box provided with a lock. The boxes containing the samples from the hogs in the cooling room so tagged will be taken to the microscopist for such establishment, who shall thereupon cause a microscopic examination of the contents of each box containing samples to be made, and shall furnish a written report to the inspector giving the result of said microscopic examination, together with the numbers of all carcasses affected with trichinæ.

The samples of pork microscopically examined shall be classified as follows:

Class A.—Samples in which there are no signs of trichinæ, living or dead, calcified cysts, or other bodies or substances having any resemblance to trichinæ cysts.

Class B.—Samples in which there are disintegrated trichinæ or trichinæ cysts, calcified trichinæ or trichinæ cysts, or bodies having any resemblance thereto.

Class C.—Samples in which there are living or dead trichinæ bodies not disintegrated.

22. All carcasses reported by the microscopist to the inspector as affected with trichinæ (Class C) shall be removed from the cooling room of said establishment under the supervision of said inspector or that of some other reliable employee of the Department of Agriculture, and shall be disposed of in accordance with the provisions of section 7, or they may be rendered into edible lard at a temperature not less than 150° F., or made into cooked meat products if the temperature is raised to the boiling point a sufficient time thoroughly to cook the interior of the pieces.

Carcasses belonging to Class B shall be rejected for shipment to countries requiring microscopic inspection. All meat belonging to Class C and which is to be cured before being cooked shall be marked with twine and seals provided for that purpose.

23. Separate cellars must be provided in which microscopically inspected meat must be cured and stored, and no other meats are to be allowed therein. These cellars must be so arranged that they can be securely locked, and the key must remain in the possession of a trusted employee of the Department, who must lock and unlock the cellar as the business requires. He must also keep an exact account of all meats going into and from the cellar.

(a) Before the cutting up of microscopically inspected carcasses is commenced, all carcasses which have been either condemned or rejected must be removed from the rail upon which the passed carcasses are hanging, and after the passed carcasses have been cut up and disposed of the condemned and rejected ones must be disposed of in accordance with these regulations.

The cutting up of carcasses which have been passed must be done under the personal supervision of an employee of the Department. Before the cutting is commenced, all benches, chutes, etc., must be cleaned of all other meats. When

it is finished a stop must be made to clear away all meats before the cutting of other hogs is begun.

(b) The greatest diligence must be exercised at abattoirs where sausage, brawn, and other products of a similar nature are prepared from microscopically inspected meat and the same are handled. Such sausage must be kept in separate compartments, provided with locks, the same as other microscopic meats, and must also be prepared in separate rooms and cut up in choppers used only for such sausage. An absolutely correct record must be kept, by weight, of all such meats, in order to prevent any but passed products being used.

(c) Whenever it is necessary to remove hams, shoulders,*sausage, or other microscopically inspected meats from their respective compartments for smoking or other preparation, a separate smokehouse or compartment must be provided, or each piece must be marked by seals affixed by an employee of this Department.

24. At all cities where inspection is established inspectors are requested to notify the municipal authorities of the character of the inspection and to cooperate with them in preventing the entry of condemned animals or their products into the local market.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 34. Amendment to B. A. I. Order No. 29.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., March 25, 1899.

Reliable information having been received that the portion of Henderson County, in the State of North Carolina, lying west of the French Broad River, is free from the infection of the disease known as splenic, or Southern, fever, it is hereby ordered that the quarantine line described in B. A. I. Order No. 29, dated December 20, 1898, be amended as follows:

Beginning at the southwest corner of the county of Cherokee; thence east along the southern boundary lines of the counties of Cherokee, Clay, Macon, Jackson, and Transylvania to the southeast corner of the county of Transylvania; thence northerly along the eastern boundary line of Transylvania County to the French Broad River; thence following the French Broad River to its intersection with the southern boundary line of Buncombe County; thence easterly along the southern boundary of Buncombe County to the summit of the Blue Ridge Mountains; thence in a northeasterly direction, following the said mountains to their intersection with the northern boundary line of the State of North Carolina.

So much of the quarantine line for the State of Virginia, described in the order of December 20, 1898 (B. A. I. Order No. 28), beginning at the southwestern corner of Grayson County and extending east along the southern boundary line of Virginia to the southeastern corner of said county, is hereby suspended during the enforcement of the above line for the State of North Carolina.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of North Carolina to enforce said quarantine line, therefore the above quarantine line is adopted for the State of North Carolina by this Department for the period beginning on this date and ending December 31, 1899, in lieu of the quarantine line described in the order of December 19, 1898, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 35.]

REGULATIONS FOR THE INSPECTION AND SAFE TRANSPORT OF ANIMALS FROM THE UNITED STATES TO FOREIGN COUNTRIES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., May 1, 1899.

Pursuant to the authority vested in the Secretary of Agriculture by virtue of section 10 of the act of Congress, approved August 30, 1890, entitled "An act providing for an inspection of meats for exportation, prohibiting the importation of adulterated articles of food or drink, and authorizing the President to make proc-

lamation in certain cases, and for other purposes;" and to the act of March 3, 1897, entitled "An act to provide for the safe transport and humane treatment of export cattle from the United States to foreign countries, and for other purposes;" and to the act of Congress, approved March 22, 1898, making appropriations for the Department of Agriculture, the following regulations are hereby prescribed for the inspection and care of such animals, and for fitting vessels engaged in the transportation of animals from the United States to foreign countries, and all previous regulations for similar inspection and export transportation are hereby rescinded; except that the previous regulations providing for fitting of vessels may be extended to June 15th next, at which time all vessels must be fitted according to these requirements:

ANIMAL INSPECTION.

1. The Chief of the Bureau of Animal Industry is hereby directed to cause careful veterinary inspection to be made of all cattle, sheep, and horses to be exported from the United States to Great Britain and Ireland and the Continent of Europe.
2. This inspection will be made at any of the following-named stock yards: Chicago, Ill.; Kansas City, Mo.; Omaha, Nebr.; St. Joseph, Mo.; National Steel Yards, Ill.; Indianapolis, Ind.; Buffalo, N. Y.; and Pittsburg, Pa., and the following ports of export, viz: Portland, Me.; Boston, Mass.; New York, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Norfolk and Newport News, Va.; Port Royal, S. C.; New Orleans, La.; and Galveston, Tex. All cattle shipped from any of the aforesaid yards must be tagged before being shipped to the ports of export. Animals arriving at ports of export from other parts of the United States will be inspected and cattle tagged at said ports.
3. After inspection at the aforesaid stock yards only animals found to be sound and free from disease, and shown not to have been exposed to the contagion of any disease shall be allowed shipment, and all cattle so inspected and passed shall be tagged under the direction of the inspector in charge of the yards. After inspection the animals passed shall be loaded into clean and disinfected cars.
4. All animals shall be inspected or reinspected at the port of export. All railroad companies will be required to furnish clean and disinfected cars for the transportation of cattle, sheep, and horses for export, and the various stock yards located at the port of export shall keep separate, clean, and disinfected stock yards and pens or stables for the use of export animals only.
5. Shippers shall notify the inspectors in charge of the yards of intended shipments of animals, the number and designation of cars in which they are to be shipped, and shall inform said inspector of the locality from which said animals have been brought, the name of the feeder of said animals, and such other information as may be practicable for proper identification of the place from which said animals have come.
6. The inspector, after passing said animals, and after the cattle have been tagged, shall notify the inspector in charge of the port of export, and also inspectors located at intermediate cities, where the animals may be unloaded for feeding and watering, of the inspection and shipment of such animals, advising him of the number and kind of animals shipped, tag numbers, and the number and designation of the cars in which said animals were shipped.
7. Export animals shall not be unnecessarily passed over any highway, or removed to cars or boats which are used for conveying other animals. Boats transporting said animals to the ocean steamer must be first cleansed and disinfected with lime wash under the supervision of the inspector of the port, and the ocean steamer must, before receiving said animals, be thoroughly cleansed or disinfected in accordance with the directions of said inspector. When passage upon or across the public highway is unavoidable in the transportation of animals from the cars to the boat, it must be under such careful supervision and restrictions as the inspector may direct.
8. Any cattle, sheep, or horses that are offered for shipment to Great Britain or Ireland or the Continent of Europe which have not been inspected and transported in accordance with this order and these regulations, or which having been inspected are adjudged to be infected or to have been exposed to infection so as to be dangerous to other animals or otherwise unfit for shipment, shall not be allowed to be placed upon any vessel for exportation.
9. The supervision of the movement of animals from cars, yards, and stables to the ocean steamer at the ports of export will be in charge of the inspector of the port.
10. The inspector at the port of export will notify the collector of the port of the various shipments of animals that are entitled to clearance papers, and when

authorized certificates of the inspection of said animals may be given to the consignors for transmission with the bills of lading.

11. The exporters of live stock or the owners, agent, or master of any vessel desiring to transport cattle, sheep, or horses from any port of the United States where inspection is established to Great Britain, Ireland, or the Continent of Europe shall notify the inspector in charge of the port from which said vessel is to clear at least two days in advance of such intended shipment, and if the regulations prescribed have been complied with a clearance will be authorized by such inspector.

SPACE.

12. Animals exported must not be carried on any part of the vessel where they will interfere with the proper management of the vessel, or with the efficient working of the necessary lifeboats, or with the requisite ventilation of the vessel, and only as hereafter specified.

CATTLE.

(a) Cattle must have 6 feet vertical space on all decks, free of all obstructions. Cattle carried on the upper or spar deck, or other exposed decks, must be allowed a space of 2 feet 6 inches in width by 8 feet in depth per head. Cattle loaded under decks must be allowed a space of 2 feet 8 inches in width by 8 feet in depth, except in the case of regular cattle ships with satisfactory ventilation, which may fit with an allowance of 2 feet 6 inches in width. No more than four head of cattle will be allowed in each pen, except at the ends of a row, where 5 may be allowed together. Provided, however, that cattle under 1,000 pounds in weight may be allowed a width of 2 feet 3 inches.

(b) Vessels will be allowed to carry three deck loads of cattle, but where it is desired to carry cattle on the lower or steerage deck it must in all cases be fitted at 2 feet 8 inches by 8 feet per head, and no animals allowed upon hatches. Special permission for carrying cattle on steerage deck must be obtained from the inspector, which will be granted in cases where said deck is provided with sufficient ventilation, as hereinafter prescribed.

SHEEP.

(c) The space for each full-grown sheep shall be 4 feet long by 14 inches wide, and for lambs or sheep under 100 pounds weight 4 feet by 12 or 13 inches—two rows of sheep standing in the 8 feet width of pen.

(d) Sheep pens shall not exceed 20 feet by 8 feet where two tiers are carried, and each tier shall have a clear vertical space of not less than 3 feet. During the summer season sheep shall not be kept in tiers under decks, but during the winter season two tiers may be placed in each wing, and only one tier amidships. One single deck of sheep may be carried upon the shelter decks for cattle during the summer season (April 1st to October 1st), when the cattle shelter decks are permanently built and the coverings of same are composed of tongued-and-grooved boards, provided such sheep fittings do not conflict with the first paragraph of this section. Such fittings shall be secured to the shelter deck in the manner provided by section 14 of these regulations.

HORSES.

(e) All horses over 14 hands in height must have 7 feet clear vertical space from beams of deck overhead to deck under foot, and so far as possible shall be placed between the overhead athwartship beams. Horses which do not exceed 1,200 pounds in weight must be allowed a space of 2 feet 8 inches in width by 8 feet in depth, in the clear, and horses weighing over 1,200 pounds shall be allowed 1 inch additional space in width for each additional 100 pounds in weight. Separate stalls must be erected for all horses. Head bumpers must be worn by all horses. Horses must not be shod when exported. A space 8 by 10 feet square should be reserved for use in caring for horses becoming sick in transit. Horses should not be placed in the same compartment with cattle; but when this is unavoidable they should be placed on opposite sides of the vessel, with partition between.

UPPER DECKS.

13. No animals shall be allowed on the poop deck or within 20 feet of the breakwater on the spar deck between the 1st of October and the 1st of April. If cattle or sheep are carried on the bridge deck proper runways shall be provided for load-

ing and unloading. Horses shall not be allowed upon the bridge deck, except when this deck is completely covered in and fitted for horses. Horses shall not be allowed upon the spar deck when temporary fittings are used between October 1st and April 1st. No cattle or horses shall be carried upon the upper decks when the outside rails measure less than 3 feet in height from the deck. When animals are carried upon the upper decks strong breakwaters shall be erected at each end and on both sides. Permanent fittings may be constructed either of iron or wood as hereinafter specified.

UPPER-DECK FITTINGS.

14. *Stanchions, wooden.*—Stanchions at least 4 inches higher than the required vertical space for cattle and horses must be 4 by 6 inches clear hard pine or spruce of equal quality, placed at proper distances from centers, against the ship's rail and inside stanchions, in their proper place directly in line with outboard stanchions, and to be set up so that the 6-inch way of the stanchions shall set fore and aft. A proper tenon shall be cut on the head of the same to receive the thwart ship beam; the tenon not to be less than 3 inches in length and the shoulder not less than 2½ inches on each side of the stanchion, thus leaving the tenon 1½ inches thick. A piece of 2 by 3 inches, or 2-inch plank, shall be fastened to the outside of stanchion and run up to underneath rail to chock stanchion down and prevent lifting when beam is sprung to crown of deck. Open-rail ships shall be blocked out on backs of stanchions fair with the outside of rails to receive the outside of planking. Where upper deck fittings are not permanent the heels of outside stanchions shall be secured by a bracing of 2 by 3 inch sound lumber from the back of each stanchion to sheer streak of waterway, the heels of inside stanchions being properly braced from and to each other. Bulwark stanchions must also be extra stanchions by raking shores running diagonally from the top of the stanchions to the deck. Rump boards must be provided on all decks where the iron framework of the ship is liable to bruise animals tied next to same, and should be closely fitted behind rows of cattle in all cases where necessary to prevent escape of manure into alleyways. For horses, wooden stanchions, as above described, must be placed at proper distances for each horse.

(a) *Stanchions, iron.*—These may be used in place of wooden stanchions, and shall not be less than 2 inches in diameter, set in iron sockets above and below and fastened with ½-inch bolts. For horses the same number of iron stanchions are required as when wooden stanchions are used.

(b) *Hook bolts or clamps.*—Hook bolts or clamps must be made of ½-inch wrought iron, with hook on outboard end, and thread and nut on inboard end, to pass over and under rail and through outboard stanchion and set up on the inside of same with a nut. These bolts may be double or single. If double, then no thread or nut is necessary, but the stanchion will lie shipped through it, thus double-hooking the rails. This will be found very useful where funnels or other deck fittings come in the way of beams passing from side to side of ship.

(c) *Beams.*—Beams must be of good sound spruce or yellow-pine lumber, 3 by 6 inches, to run clear across the ship's beam where practicable. Should any horse or deck fittings be in the way, then butt up closely to the same. These beams shall have a 1½ by 4 inch mortise to receive the tenon of each and every stanchion, and to take the same crown as deck of ship by springing down to shoulder of outside stanchions, and to be properly pinned or nailed to tenon and wedged tightly afterwards. The mortises shall be cut not less than 6 inches from outside ends of beams and a piece nailed on outside of same, and trimmed off fair with beam ends to prevent splitting.

(d) *Diagonal braces from stanchions to beams.*—Diagonal braces shall be fastened on each stanchion on both sides of same, running up to top side of beam and properly secured by well nailing to both stanchion and beam.

(e) *Headboards.*—Headboards shall not be less than 2 by 10 or 3 by 8 inches, of good sound spruce or yellow-pine lumber, and secured at every stanchion by ½-inch screw bolts passing through same and set up on same with a nut. Where headboards butt on the stanchions a piece of iron ½ inch thick and 3 inches square shall be placed over the boards like the butt strap. These headboards can be placed on either side of the stanchion. All headboards shall have 1½-inch holes bored through them at proper distances to tie the animal.

(f) *Head pipes.*—In place of wooden headboards two wrought-iron pipes not less than 2 inches in diameter may be used, placed 8 inches apart. Said head pipes to be made continuous by having a wrought-iron threaded collar securely fastened on the end of each length of pipe into which the next length may be inserted or screwed. Both head pipes to be held in place by means of heavy wrought-iron straps, bolted to each stanchion by four ½-inch bolts; the lower head pipe being fitted with mov-

able clamps, holding a ring of suitable size to which cattle may be tied. Said clamps to be set at the proper distance apart, in accordance with the regulations, and fastened to the pipe with screws.

(g) *Footboards*.—Footboards shall be of wood and of the same dimensions as headboards, properly nailed or bolted to stanchions on the inside of same.

(h) *Division boards*.—Division boards for cattle shall be of 2 by 8 inch sound spruce or yellow pine, fitted so as to be removable at any time and so arranged as to divide the animals into lots of four except at ends of rows and when cattle weighing less than 1,000 pounds are carried, thus making compartments for this number all over the vessel. These division boards shall be fitted perpendicularly.

(i) *Division pipes*.—In place of wooden division boards 3 wrought-iron pipes, not less than 2 inches in diameter, may be used, placed 6 inches apart athwartship, set in iron sockets above and below and fastened with $\frac{3}{4}$ -inch bolts.

(j) *Division boards for horses*.—Division boards for horses shall be not less than 2 by 9 inches by 8 feet, sound lumber, planed, and placed horizontally between the horses, with spaces between of not less than 2 inches; the partition to extend from the deck underfoot to within at least 18 inches of the deck overhead.

(k) *Flooring*.—Where flooring is required it shall be of 1-inch spruce boards, laid fore and aft on ships with wooden decks. Iron-decked ships shall be sheathed with 2-inch spruce or yellow pine or with 1-inch spruce; but if 1-inch lumber is used the foot locks shall be 3 by 4, and laid so that they will properly secure the 1-inch boards, thus preventing them from slipping and at the same time acting as foot locks by showing a surface of 2 by 4 inches. It is optional with the owners whether they permit sheathing to be used on their ships with wooden decks or whether they allow foot locks to be secured to the deck. But on iron decks it is absolutely necessary (if permanent foot locks are not down) to sheath them before putting down foot locks in order to fasten same. Cement, diagonally scored $\frac{1}{4}$ inch deep, may be used on iron decks instead of wood sheathing if the foot locks be molded in same and bolted to the deck. If the flooring is raised on any of the decks it shall not be less than 2 inches thick, with scantlings 2 by 3 inches thick, laid athwartships on the deck, not over 18 inches apart, with 2-inch plank for flooring nailed to them.

(l) When the pens for sheep are built for two tiers, the flooring between the tiers shall be laid with tongued-and-grooved boards; the stanchions shall be 4 by 6 inch spruce lumber and shall be secured to the beams overhead by angle braces similar to cattle fittings. Outside planking for sheep pens shall be of 2-inch spruce or 1½-inch yellow pine lumber secured to 4 by 6 inch spruce stanchions with hook bolts similar to cattle fittings.

(m) *Foot locks*.—Foot locks shall be of good, sound spruce or yellow pine lumber or hard wood, size 2 by 4 inches, laid fore and aft, placed 12 inches, 14 inches, 2 feet 2 inches, and 14 inches apart, the first one distant 12 inches from the inside of footboard. Where temporary fore-and-aft foot locks are used they shall be filled in athwartships opposite each stanchion, properly secured to sheathing or deck, and secured by a batten of spruce or yellow pine 2 by 3 inches thick to go over all from stanchion to stanchion. Where permanent foot locks securely bolted to iron decks are used, the athwartship braces between foot locks from stanchion to stanchion and batten may be omitted when the stanchion is securely fitted in iron socket bolted to the deck. Uncovered iron decks may be arranged for cattle with athwartship foot locks 2 by 4 inches, and must be placed between the first and second, second and third, third and fourth fore-and-aft foot locks, to be at equal distances from each other, thus forming a space for each animal, and must be securely fastened to decks. In pens at each end of rows where five cattle are carried there must be additional athwartship foot locks provided. When troughs are used, fore-and-aft foot locks will be placed 17, 16, 22, and 16 inches apart. A space of 2 inches may be left between the ends of athwartship foot locks and fore-and-aft foot locks when the former are securely bolted to the deck. When fore-and-aft foot locks are permanent, a 2-inch space shall be left between ends at the end of each section. Vessels now fitted with 3 by 4 inch foot locks will not be required to use 2 by 4 inch foot locks except when the former are replaced.

(n) *Outside planking*.—All outside planking on open and closed rail ships must be properly laid fore and aft of ship, and nailed to the backs of stanchions, as close as possible for the cold season, and for the warmer months the top-course planking shall be left off fore and aft of ship in order to allow a free circulation of air. Nothing less than 2-inch spruce or 1½-inch yellow pine is to be used for this purpose.

(o) Planking on shelter deck is to be erected on all exposed decks. The planks to form the shelter deck, which must be erected on all exposed decks, shall be laid with 2-inch sound spruce or yellow pine lumber or with 1½-inch sound spruce or

yellow pine lumber if tongued and grooved, sufficient to cover cattle. These planks shall be laid as closely as possible and well nailed to the beams, thus making a good deck from which to work the ship's gear.

(p) *Nails*.—No nails less than 20-penny wire shall be used in foot locks or where 2-inch material is used. Twelve-penny wire nails must be used in 1½-inch plank or under.

(q) No cattle fittings shall be erected over permanent spar-deck fittings forward and aft of the midship section until permission has first been obtained from the Chief of Bureau of Animal Industry.

UNDER-DECK FITTINGS.

When the fittings on the spar deck are permanent, and hatches overhead are provided, the same regulations for ventilation shall apply as provided for under decks.

(r) *Stanchions*.—Stanchions shall be at least 4 inches higher than the required vertical space for horses or cattle, and of good sound spruce or yellow pine lumber, 4 by 6 inches, set up at proper distances from centers so that the 6-inch way of same shall stand fore and aft, and jammed in tight between the two decks, properly braced on head and from side to side of ship; this bracing shall be of 2 by 3 inch spruce or yellow pine, and be properly butted against each stanchion. Where it is found impracticable to run these braces across ship by reason of hatches, etc., coming in the way, they shall be well braced from hatch coamings and from the obstructions which prevent running braces from side to side. The heads of these stanchions shall be braced fore and aft by 2 by 3 inch pieces well nailed on each stanchion and running fore and aft close up to the lower edge of the ship's beams, and butted at each end of compartment and against themselves, or chocked in underneath beam and well nailed to heads of stanchions. If upper and lower decks are wood, then the stanchions set up between decks may be secured by well cleating to each deck at heads and heels of same.

(s) *Headboards*.—Headboards shall be of the same dimensions and same material as those on the upper deck and fastened and arranged in the same manner.

(t) *Footboards*.—Footboards shall be of the same dimensions and same lumber as those on the upper deck and fastened in the same manner.

(u) *Division boards*.—Division boards shall be of the same dimensions and material as those of the upper decks and fastened and arranged in the same manner.

(v) *Flooring*.—Where ships have decks of wood it shall be optional with owners whether they have boards put down to protect decks or whether they allow the foot locks to be nailed to the ship's deck. (Permanent foot locks may be put down.) If the decks are of iron then wooden flooring must be laid either of a 2-inch spruce with 2 by 4 inch foot locks or of 1-inch spruce with 3 by 4 inch foot locks, same as provided for upper decks. Iron decks may be covered with cement or fitted with athwartship foot locks, as provided for iron upper decks.

(w) *Foot locks*.—Foot locks shall be arranged the same as provided for upper decks.

(x) *Troughs*.—Suitable troughs may be built on the footboards, about 12 inches wide, when required for cattle, on either deck, by fastening footboards on outside of stanchions and fitting up on the inside. Removable troughs must be used for horses. Suitable troughs for grain and water must be provided on three sides of each sheep pen.

(y) *Casing for steering gear*.—Suitable casing must be placed over ship's steering gear when found necessary.

(z) *Alleyways*.—Alleyways in front and between pens used for feeding and watering cattle must have a width of 3 feet, except at ends of alleyways in bow and stern of ship, and where obstructions occur the width may be reduced to a minimum of 18 inches; alleyways front and between pens used for feeding and watering horses must have a minimum width of 3 feet. Two or more athwartship alleyways, at least 18 inches wide, must be left on each side of deck, so that the scuppers can be readily reached and kept clear of obstructions. For sheep athwartship alleyways not less than 18 inches wide in the clear shall be left between pens, and fore-and-aft alleyways 3 feet wide in front of each pen, except at obstructions and at ends of alleyways, as provided for cattle, there may be a minimum width of 18 inches. When two tiers of sheep are carried, the minimum width of the fore-and-aft alleyways in bow and stern of ship shall be 2 feet clear of all obstructions.

VENTILATION AND LIGHT.

15. Each under-deck compartment not exceeding 50 feet in length must have at least four bell-mouth ventilators of not less than 18 inches in diameter and with tops exceeding 7 feet in height above shelter deck, two situated at each end of the compartment. Compartments over 50 feet long must have additional ventilators of same dimensions or efficient fans.

(a) When it is desired to carry animals upon the third deck a special permit must be obtained from the inspector of the port. The vessel must be fitted as hereinbefore specified, lighted with electric lights, and properly ventilated. One set of ventilators should be trimmed to the wind and another set in the opposite direction. They must be tested previous to issuance of permit and kept in easy working order.

(b) Suitable arrangements must be made to provide at all times sufficient light for the proper tending of all animals.

(c) No cattle should be loaded along the alleyways by engine room unless the sides of said engine room are covered by 1½-inch grooved-and-tongued lumber, making a 3-inch air space.

(d) When horses are carried under decks canvas bags of size of ventilator, provided with iron rings at the bottom, shall be attached to the down-take of fresh-air ventilators and reach to within 18 inches of the deck under foot.

HATCHES.

16. No animals shall be loaded upon hatches on decks above animals nor upon third-deck hatches when animals are carried upon such deck, nor shall any merchandise, freight, or food for animals be loaded upon said hatches, but said hatches shall at all times be kept clear.

(a) No cattle shall be loaded upon any hatch where the coamings exceed 18 inches in height, and there shall be not less than 6 feet vertical space between the beams overhead and the hatch coamings under foot.

(b) In loading animals on upper decks four of the largest hatches shall be kept free of animals—one hatch forward, one aft, and two amidship—so that the intervening space will be proportioned as equally as possible. Animals may be placed upon hatches in excess of this number.

(c) Horses shall not be allowed upon any hatches.

FOOD AND WATER.

17. All vessels shall carry casks and hogsheads of not less than 400 gallons total capacity for each 100 head of cattle and horses, and an additional amount, in equal proportion, shall also be carried for sheep, and these shall be filled with fresh water before sailing and refilled as emptied. All water tanks for use of animals must be filled with good fresh water before sailing.

(a) Each vessel shall carry water condensers, which are in good working order and of sufficient capacity to provide 8 gallons of fresh, cold water each twenty-four hours for each head of cattle, in addition to the amount required by other animals on board and for other purposes.

(b) *Feed.*—Not more than two days' feed for the animals shall be allowed to be carried on deck; this shall be properly covered and shall be the first feed used. All other feed shall be under hatches.

(c) Sufficient room must be left at the side of hatches to permit the feed in the hold being readily removed and handled.

ATTENDANTS.

18. The employment of all attendants shall be subject to the approval of the owners or agents of steamships and of the inspector of the port, and men so employed shall be reliable and signed as part of the ship's crew and under the control of the captain of said vessel. They shall be furnished with well-lighted and well-ventilated quarters—as good as the same accommodations furnished the crew of the ship. Experienced foremen shall be in charge of the animals, and not less than two-thirds of the attendants must be experienced men who have made previous trips with stock. The shippers of export animals or their agents shall make affidavit concerning the character of the attendants.

(a) There shall be one attendant for each 35 head of cattle upon steamers having water pipes extending the entire length of both sides of compartments, and upon steamers not so fitted there shall be one attendant to each 25 head of cattle shipped.

(b) There shall also be additional help furnished by the captain of the vessel when water has to be pumped by hand.

(c) There shall be one experienced man in charge of each 150 head of sheep during the winter season (October 1st to April 1st), and one to each 200 sheep during the summer season.

(d) For horses there shall be one attendant to each 18 head.

HEAD ROPES.

19. Cattle shall be tied with $\frac{3}{4}$ -inch rope, which shall not be used more than once, and must be either manila, sisal, or jute.

(a) All head ropes returned to the United States shall be immediately seized and destroyed by the inspector.

(b) All halters returned to the United States that have been used for horses shall be seized and destroyed by the inspector.

(c) Blankets, stable utensils, and feed troughs, if returned to this country, must be disinfected under the supervision of inspector of the port.

FALSE DECKS.

20. False decks upon which cattle are loaded must be removed and the manure and dirt cleaned from underneath before receiving another load of cattle.

INSPECTING, TAGGING, AND REST.

21. No vessel shall be permitted to take on board any cattle or sheep unless the same have been allowed at least 12 hours' actual rest in the yards at the port of embarkation before the vessel sails, nor until the loading of the other cargo has been completed.

(a) All cattle must remain a sufficient length of time in yards during daylight at the port of embarkation before the vessel sails, for the purpose of inspection and tagging.

(b) No vessel shall be permitted to take on board any horses unless the same have been allowed at least 24 hours' actual rest in the stable or stables set apart for export horses at the port of embarkation before the vessel sails, nor until the loading of the other cargo has been completed.

DEFECTIVE FITTINGS.

22. The inspector may, in case he finds that any of the fittings are worn, decayed, defective in construction, or appear to be unsound, require the same to be replaced before he authorizes the clearance of the vessel.

LOADING.

23. The inspector will supervise the loading of the animals and see that they are properly stowed and tied; that a sufficient amount of good, wholesome feed is properly stowed, and that all the requirements of these regulations have been complied with. In case the regulations have not been complied with he will immediately notify the chief of the Bureau.

INJURED ANIMALS.

24. Animals suffering from broken limbs or other serious injuries during the voyage shall be slaughtered by direction of the captain of the vessel.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 36. Additional to B. A. I. Orders Nos. 25 and 30.]

SPECIAL ORDER PLACING CERTAIN COUNTIES IN TEXAS IN QUARANTINE.

U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF THE SECRETARY,
Washington, D. C., June 21, 1899.

In consequence of the regulations of the State of Texas and the establishment of a quarantine upon certain counties hereinafter named by the duly constituted authorities of that State--

It is hereby ordered, That no cattle be removed from the counties of Hardeman, Childress, Hall, Motley, Cottle, King, Dickens, Crosby, Garza, Kent, Stonewall, Scurry, Borden, Howard, and Glasscock, in the State of Texas, to, or be allowed to pass through, any uninfected area except in the manner prescribed by the regulations concerning cattle transportation (B. A. I. Order No. 24) issued by this Department December 19, 1898, unless satisfactory evidence is given that they are not affected with splenetic, or Texas, fever, and have not been exposed to the contagion thereof, in which case a special permit for such movement may be issued by an inspector of the Bureau of Animal Industry or by an inspector of the Texas live stock sanitary commission.

This order will remain in force for the period beginning on this date and ending November 1, 1899, for said area, except as otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 37. Supplementary to B. A. I. Order No. 24.]

SPECIAL ORDER PROVIDING FOR RETURN TO NON-INFECTED DISTRICT OF CATTLE EXHIBITED AT STATE FAIR AT RALEIGH, N. C.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 18, 1899.

It is hereby ordered, That cattle from above the quarantine line, and which have been shipped directly from the noninfected district to the fair grounds at Raleigh, N. C., for exhibition at the State fair of 1899, and which are returned without having been unloaded elsewhere, be permitted to return as uninfected cattle, providing they are accompanied by a certificate of the veterinarian of the North Carolina department of agriculture showing that they have had no opportunity to become infected with the *Boophilus bovis* tick while at said fair grounds.

J. H. BRIGHAM, *Acting Secretary.*

[B. A. I. Order No. 38.]

REGULATIONS CONCERNING THE DIPPING OF SHEEP AFFECTED WITH SCABIES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 20, 1899.

Whereas the shipment of live stock affected with any contagious, infectious, or communicable disease from one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, is prohibited by the act of Congress approved May 29, 1884; and

Whereas the contagious disease of sheep known as scabies, or scab, exists in many parts of the United States, due notice of which was given in the Department order of June 18, 1897; and

Whereas some of the preparations in which diseased sheep have been dipped by owners and stock-yard companies, with the object of destroying the contagion and making legal the shipment of said sheep in interstate trade, have proved inefficient, and said sheep have disseminated the contagion notwithstanding such treatment; and

Whereas the damage and losses from scabies in sheep have been in some sections very heavy and discouraging to those engaged in the sheep industry:

It is ordered, That from and after August 10, 1899, no sheep affected with scabies, and no sheep which have been in contact with others so affected, shall be allowed shipment from one State or Territory into another, or from any State into the District of Columbia, or from the District into any State, unless said sheep shall have first been dipped in a mixture approved by this Department.

The dips now approved are:

1. The tobacco-and-sulphur dip, made with sufficient extract of tobacco to give a mixture containing not less than five one-hundredths of one per cent of nicotine and two per cent flowers of sulphur.

The lime-and-sulphur dip, made with eight pounds of unslaked lime and twenty-four pounds of flowers of sulphur to one hundred gallons of water. The lime and sulphur should be boiled together for not less than two hours, and all sediment allowed to subside before the liquid is placed in the dipping vat.

The owner of the sheep is privileged to choose which one of the above-mentioned dips shall be used for his animals. The Department will instruct inspectors to enforce due care in dipping sheep, but it assumes no responsibility for loss or damage to such animals, and persons who wish to avoid any risks that may be incident to dipping at the stock yards should see that their sheep are free from disease before they are shipped to market.

J. H. BRIGHAM, *Acting Secretary.*

[B. A. I. Order No. 39.]

REGULATIONS FOR THE INSPECTION AND CERTIFICATION OF GRADED CATTLE FOR CUBA.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 21, 1899.

In accordance with the provisions of Tariff Circular No. 83, dated July 12, 1899, issued by the Secretary of War, providing for the admission into Cuba free of duty of fifty thousand head of graded cows and bulls for breeding purposes, immune to the effects of the fever tick, under such regulations as may be prescribed by the Secretary of Agriculture—

It is ordered, That to secure the benefit of this provision all animals must arrive in Cuba not later than June 30, 1900, and all must be shipped from one or more of the following ports, viz: Savannah, Mobile, New Orleans, or Galveston. The animals will be inspected by an inspector of this Department at the port of shipment, and if they are found to be graded cows and bulls suitable for breeding purposes, free from disease, and immune from the fever tick, the inspector will issue a certificate embodying these facts, which certificate should accompany the cattle and be presented to the customs officer at the port of landing. The certificate will indicate to the customs authorities that the cattle have been duly inspected under the regulations of this Department and that they come within the terms of the above-mentioned order made by the Secretary of War. No animals will be certified unless satisfactory evidence is presented that they were raised in the fever district as defined in this Department's order of December 12, 1898, and amendments thereto, and that they are immune from that disease. In case of doubt the inspector may require that an affidavit stating the facts be filed by the owner or agent.

Notification of intention to ship cattle under the provisions of this order should be given this Department a sufficient time in advance of shipment to insure the presence of an inspector at the port of export.

The cattle must be given not less than six hours' rest in the stock yards before being loaded upon vessels, and suitable space and ventilation must be provided to avoid suffering or cruelty during the passage.

J. H. BRIGHAM, *Acting Secretary.*

TARIFF CIRCULAR NO. 83.

WAR DEPARTMENT,
Washington, July 12, 1899.

By direction of the President, the Governor-General of Cuba is hereby authorized to admit from time to time, but not after July 1, 1900, free of duty, graded bulls and cows for breeding purposes, under such regulations as may be prescribed by the Secretary of Agriculture, to a total number of fifty thousand.

Paragraph 203, on page 65 of the "Amended Customs Tariff and Regulations for ports in Cuba in Possession of the United States," is therefore temporarily amended accordingly.

Such cattle must be immune from the effects of the fever tick and free from disease.

This order will be duly proclaimed and enforced in the island of Cuba.

R. A. ALGER, *Secretary of War.*

[B. A. I. Order No. 40. Revocation of B. A. I. Order No. 39.]

**ORDER REVOKING REGULATIONS FOR THE INSPECTION AND
CERTIFICATION OF GRADED CATTLE FOR CUBA.**

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 28, 1899.

Whereas it has been decided that the cattle to be admitted into Cuba free of duty for breeding purposes shall be inspected at Cuban ports under the direction of the Secretary of War:

It is ordered, That B. A. I. Order No. 39, dated July 21, 1899, prescribing regulations for the inspection and certification of graded cattle for Cuba, be and the same is hereby revoked.

J. H. BRIGHAM, *Acting Secretary*.

[B. A. I. Order No. 41.]

**SPECIAL ORDER RELEASING CATTLE IN THE COUNTIES OF UNION,
TOWNS, AND PART OF RABUN, GEORGIA, FROM THE RESTRICTIONS
IMPOSED BY THE REGULATIONS OF DECEMBER 19, 1898
(B. A. I. ORDER NO. 24), AND MODIFICATIONS THEREOF, CONCERNING
CATTLE TRANSPORTATION.**

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 1, 1899.

It is hereby ordered, That cattle now in the territory hereinafter described and which are free from the *Boophilus bovis* (Southern cattle tick) may be moved without restriction to points north of the quarantine line defined in the regulations of December 19, 1898 (B. A. I. Order No. 24), as modified by special orders dated December 20, 1898 (B. A. I. Orders Nos. 25-29).

Provided, That application be first made to the Secretary of Agriculture and permission received for the removal of such cattle; said application to give the name of the owner, the origin and number of the cattle, the place from which they are to be moved and the destination, with the route to be followed, which must not be through any area infested with Southern cattle ticks.

This order applies only to the following described territory in the State of Georgia: The whole of the counties of Union and Towns and that part of Rabun County lying north and west of a line drawn from its western corner, near the mouth of Wild Cat Creek, in an easterly direction, through Charlie Mountain, Glassie Mountain, and Tiger Mountain, and along the ridge following Stekoa Creek to Dick Creek, thence northerly through Rainy Mountain, Hogback Ridge, Pinnacle, Raven Knob, Rock Mountain, and Rabun Bald to the State boundary.

This order will remain in force until the termination of November 1, 1899, unless otherwise ordered.

J. H. BRIGHAM, *Acting Secretary*.

[B. A. I. Order No. 42. Additional to B. A. I. Order No. 26.]

**SPECIAL ORDER PLACING WASHITA COUNTY, OKLAHOMA
TERRITORY, IN QUARANTINE.**

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 4, 1899.

In consequence of the existence of Southern, or splenic, fever among cattle in the county of Washita, in the Territory of Oklahoma—

It is hereby ordered, That the county above named be added to the area quarantined by the special order modifying quarantine line for the Territory of Oklahoma, dated December 20, 1898 (B. A. I. Order No. 26), and the movement of cattle from said county to or through any uninfected area shall not be permitted, except in the manner prescribed by the regulations concerning cattle transportation, issued by this Department December 19, 1898 (B. A. I. Order No. 24).

This order will remain in force until otherwise ordered.

J. H. BRIGHAM, *Acting Secretary*.

[B. A. I. Order No. 43. Supplementary to B. A. I. Order No. 24.]

SPECIAL ORDER PROVIDING FOR RETURN TO NONINFECTED DISTRICT OF CATTLE EXHIBITED AT STATE FAIR AT SACRAMENTO, CALIFORNIA.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 28, 1899.

It is hereby ordered, That cattle from above the quarantine line, and which have been shipped directly from the noninfected district to the fair grounds at Sacramento, California, for exhibition at the State fair of 1899, and which are returned without having been unloaded elsewhere, be permitted to return as uninfected cattle, providing they are accompanied by a certificate of the State veterinarian of California showing that they have had no opportunity to become infected with the *Boophilus bovis* while at said fair grounds.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 44.]

SPECIAL ORDER PROVIDING ADDITIONAL PORTS OF EXPORT FOR CANADIAN CATTLE IN BOND.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 28, 1899.

It is hereby ordered, That Canadian cattle and sheep shipped in bond may be admitted for export from Philadelphia, Pa., Baltimore, Md., and Newport News, Va., in addition to the ports named in section 6 of the regulations of this Department, dated January 23, 1897, subject to conditions named in said section.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 45. Amendment to B. A. I. Order No. 24.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF CALIFORNIA.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 30, 1899.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of California has located a quarantine line as follows:

Beginning on the Pacific coast, where the southern boundary line of Marin County connects with the Pacific Ocean; thence easterly and northerly along the southern and eastern boundary lines of Marin and Sonoma counties to the intersection of Sonoma and Solano counties; thence following the western, northern, and eastern boundary lines of Solano County to the Sacramento River; thence northerly along the eastern boundary line of Yolo County to its intersection with the boundary line of Sutter County; thence easterly along the southern boundary lines of Sutter and Placer counties to the intersection with the western boundary line of El Dorado County; thence southerly and easterly along the southern boundary line of El Dorado County to the intersection with the western boundary line of Alpine County; thence in a southerly direction along the western boundary line of Alpine County; thence in a southerly direction along the western boundary lines of Alpine, Mono, and Inyo counties to the southwestern boundary of Inyo County; thence east along the southern boundary of Inyo County to its intersection with the eastern boundary line of the State of California.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of California to enforce said quarantine line, therefore the above quarantine line is adopted for the State of California by this Department for the period beginning on this date and ending December 31, 1899, in lieu of the quarantine line described in the order of December 19, 1898, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 46—Superseding previous regulations.]

REGULATIONS FOR THE INSPECTION AND SAFE TRANSPORT OF ANIMALS FROM THE UNITED STATES TO FOREIGN COUNTRIES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 21, 1899.

Authority under which made. Pursuant to the authority vested in the Secretary of Agriculture by virtue of section 10 of the act of Congress, approved August 30, 1890, entitled "An act providing for an inspection of meats for exportation, prohibiting the importation of adulterated articles of food or drink, and authorizing the President to make proclamation in certain cases, and for other purposes," and to the act of March 3, 1891, entitled "An act to provide for the safe transport and humane treatment of export cattle from the United States to foreign countries, and for other purposes," and to the act of Congress approved March 22, 1898, making appropriations for the Department of Agriculture, the following regulations are hereby prescribed for the inspection and care of such animals, and for fitting vessels engaged in the transportation of animals from the United States to foreign countries, and all previous regulations for similar inspection and export transportation are hereby rescinded:

INSPECTION AND SHIPMENT.

Animals subject to inspection. 1. The Chief of the Bureau of Animal Industry is hereby directed to cause careful veterinary inspection to be made of all cattle, sheep, and horses to be exported from the United States to Great Britain and Ireland and the continent of Europe. The word "horses" when used in these regulations refers to and includes mules and asses.

Cities where animals may be inspected. (a) This inspection will be made at any of the following named stock yards: Chicago, Ill.; Kansas City, Mo.; Omaha, Nebr.; St. Joseph, Mo.; National Stock Yards, Ill.; Indianapolis, Ind.; Buffalo, N. Y., and Pittsburg, Pa., and the following ports of export, viz: Portland, Me.; Boston, Mass.; New York, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Norfolk and Newport News, Va.; Port Royal, S. C.; New Orleans, La., and Galveston, Tex. All cattle shipped from any of the aforesaid yards must be tagged before being shipped to the ports of export. Animals arriving at ports of export from other parts of the United States will be inspected and cattle tagged at said ports.

Animals allowed shipment. (b) After inspection at the aforesaid stock yards, only animals found to be sound and free from disease, and shown not to have been exposed to the contagion of any disease, shall be allowed shipment, and all cattle so inspected and passed shall be tagged under the direction of the inspector in charge of the yards. After inspection the animals passed shall be loaded into clean and disinfected cars.

Clean cars, yards, etc., required. (c) All animals shall be inspected or reinspected at the port of export. All railroad companies will be required to furnish clean and disinfected cars for the transportation of cattle, sheep, and horses for export, and the various stock yards and stable owners located at the ports of export shall keep separate, clean, and disinfected stock yards and pens or stables for the use of export animals.

Identification of animals. (d) Shippers shall notify the inspector in charge of the yards of intended shipments of animals, the number and designation of cars in which they are to be shipped, and shall inform said inspector of the locality from which said animals have been brought, the name of the feeder of said animals, and such other information as may be practicable for proper identification of the place from which said animals have come.

Notification of shipment to ports. (e) The inspector, after passing said animals, and after the cattle have been tagged, shall notify the inspector in charge of the port of export, and also inspectors located at intermediate cities, where the animals may be unloaded for feeding and watering, of the inspection and shipment of such animals, advising him of the number and kind of animals shipped, tag numbers, and the number and designation of the cars in which said animals were shipped.

Transportation from yards to steamers. (f) Export animals shall not be unnecessarily passed over any highway, or removed to cars or boats which are used for conveying other animals.

Boats transporting said animals to the ocean steamer must be first cleansed and disinfected with lime wash under the supervision of the inspector of the port, and

the ocean steamer must, before receiving said animals, be thoroughly cleansed or disinfected in accordance with the directions of said inspector. When passage upon or across the public highway is unavoidable in the transportation of animals from the cars to the boat, it must be under such careful supervision and restrictions as the inspector may direct.

Animals not allowed shipment. (g) Any cattle, sheep, or horses that are offered for shipment to Great Britain or Ireland or the continent of Europe which have not been inspected and transported in accordance with this order and these regulations, or which, having been inspected, are adjudged to be infected or to have been exposed to infection so as to be dangerous to other animals or otherwise unfit for shipment, shall not be allowed to be placed upon any vessel for exportation.

Supervision to steamers. (h) The supervision of the movement of animals from cars, yards, and stables to the ocean steamer at the ports of export will be in charge of the inspector of the port.

Clearance and certificates. (i) The inspector at the port of export will notify the collector of the port or his deputy of the various shipments of animals that are entitled to clearance papers, and when authorized certificates of the inspection of said animals may be given to the consignors for transmission with the bills of lading.

Notification to inspectors of shipments on steamers. (j) The exporters of live stock or the owners, agent, or master of any vessel desiring to transport cattle, sheep, or horses from any port of the

United States where inspection is established to Great Britain, Ireland, or the continent of Europe shall notify the inspector in charge of the port from which said vessel is to clear at least two days in advance of such intended shipment, and if the regulations prescribed have been complied with a clearance will be authorized by such inspector.

SPACE.

Space not allowed to be used. 2. Animals exported must not be carried on any part of the vessel where they will interfere with the proper management of the vessel, or with the efficient working of the necessary lifeboats, or with the requisite ventilation of the vessel, and only as hereinafter specified.

Cattle. (a) Cattle must have 6 feet vertical space on all decks, free of all obstructions; dehorned cattle may, however, be placed on raised floors over pipes and other similar obstructions where the vertical space is 5 feet and 6 inches. Cattle carried on the upper or spar deck, or other exposed decks, must be allowed a space of 2 feet 6 inches in width by 8 feet in depth per head. Cattle loaded under decks must be allowed a space of 2 feet 8 inches in width by 8 feet in depth, except in the case of regular cattle ships with satisfactory ventilation, which may fit with an allowance of 2 feet 6 inches in width. No more than 4 head of cattle will be allowed in each pen, except at the ends of a row, where 5 may be allowed together. Provided, however, that cattle under 1,000 pounds in weight may be allowed a width of 2 feet 3 inches. Cattle in single stalls shall have 3 feet in width.

Vessels will be allowed to carry three deck loads of cattle, but where it is desired to carry cattle on the lower, or steerage, deck it must in all cases be fitted at 2 feet 8 inches by 8 feet per head, and no animals allowed upon hatches. Special permission for carrying cattle on steerage deck must be obtained from the inspector, which will be granted in cases where said deck is provided with sufficient ventilation, as hereinafter prescribed.

Sheep. (b) The space for each full-grown sheep shall be 4 feet long by 14 inches wide, and for lambs or sheep under 100 pounds weight 4 feet by 12 or 13 inches—two rows of sheep standing in the 8 feet width of pen.

Sheep pens shall not exceed 20 feet by 8 feet where two tiers are carried, and each tier shall have a clear vertical space of not less than 3 feet. During the summer season sheep shall not be kept in tiers under decks, but during the winter season two tiers may be placed in each wing, and only one tier amidships. One single deck of sheep may be carried upon the shelter decks for cattle when the cattle shelter decks are permanently built and are composed of tongued-and-grooved boards, provided such sheep fittings do not conflict with the first paragraph of this section. Such fittings shall be secured to the shelter deck in the manner provided by section 3 of these regulations.

Horses. (c) All horses must have 6 feet 3 inches clear vertical space from beams of deck overhead to deck under foot, and so far as possible shall be placed between the overhead athwartship beams. Horses must be allowed a space of 2 feet 6 inches in width by 8 feet in depth; an additional space may be required by the inspector for very large horses. Separate stalls must be erected for all horses. When horses are placed directly under athwartship beams the beams must be

guarded by 4-inch strips of wood fastened to both sides of the beam. A space 8 by 10 feet square must be reserved on each steamer carrying 22 or more horses for use in caring for horses becoming sick in transit. Horses, when placed in the same compartment with cattle, must be separated by fore-and-aft alleyways and temporary athwartship bulkheads, the length of which shall not be less than the depth of the stalls.

UPPER DECKS.

3. No animals shall be allowed on the poop deck or within 20 feet of the breakwater on the spar deck between the 1st of October and the 1st of April. If cattle or sheep are carried on the bridge deck, proper runways shall be provided for loading and unloading. Horses shall not be allowed upon the bridge deck, except when this deck is completely covered in and fitted for horses. Horses shall not be allowed upon the spar deck when temporary fittings are used between October 1st and April 1st. No cattle or horses shall be carried upon the upper decks where the outside rails measure less than 3 feet in height from the deck. When animals are carried upon the upper decks, strong breakwaters shall be erected at each end and on both sides. Permanent fittings may be constructed either of iron or wood, as hereinafter specified.

Alleyways. (a) All steamers now engaged in carrying cattle, sheep, and horses for export, and which are permanently fitted, may receive such animals for transportation upon the approval of the deck plans by the Chief of the Bureau of Animal Industry. Such plans must be submitted for approval and required alterations made before July 1 next. All other steamers will be required to provide alleyways as provided by this section. Alleyways in front and between pens used for feeding and watering cattle must have a width of 3 feet, except at ends of alleyways in bow and stern of ship, and where obstructions less than 3 feet in length occur the width may be reduced to a minimum of 18 inches; alleyways in front and between pens used for feeding and watering horses must have a minimum width of 3 feet. Two or more athwartship alleyways at least 18 inches wide must be left on each side of deck, so that the scuppers can be readily reached and kept clear of obstructions. For sheep athwartship alleyways not less than 18 inches wide in the clear shall be left between pens and fore-and-aft alleyways 3 feet wide in front of each pen, except at obstructions and at ends of alleyways, as provided for cattle, there may be a minimum width of 18 inches. When two tiers of sheep are carried, the minimum width of the fore-and-aft alleyways in bow and stern of ship shall be 2 feet clear of all obstructions. Sufficient space must be left at the sides of hatches to permit the feed in the hold to be readily removed and handled.

Stanchions, wooden, and rump boards. (b) Stanchions at least 4 inches higher than the required vertical space for cattle and horses must be 4 by 6 inch clear hard pine or spruce of equal quality, placed at proper distances from centers, against the ship's rail and inside stanchions, in their proper place directly in line with outboard stanchions, and to be set up so that the 6-inch way of the stanchions shall set fore and aft. A proper tenon shall be cut on the head of the same to receive the thwartship beam; the tenon not to be less than 3 inches in length and the shoulder not less than $2\frac{1}{2}$ inches on each side of the stanchion, thus leaving the tenon $1\frac{1}{2}$ inches thick. A piece of 2 by 3 inches, or 2-inch plank, shall be fastened to the outside of stanchion and run up to underneath rail to chock stanchion down and prevent lifting when beam is sprung to crown of deck. Open-rail ships shall be blocked out on backs of stanchions fair with the outside of rails to receive the outside of planking. Where upper-deck fittings are not permanent, the heels of outside stanchions shall be secured by a bracing of 2 by 3 inch sound lumber from the back of each stanchion to sheer streak of waterway, the heels of inside stanchions being properly braced from and to each other. Bulwark stanchions must also be extra stanchioned by raking shores running diagonally from the top of the stanchions to the deck. Rump boards must be provided on all decks where the iron framework and other obstructions of the ship are liable to bruise animals tied next to same and at such other places where required for the safety of the animals, and should be closely fitted behind rows of cattle in all cases where necessary to prevent escape of manure into alleyways. For horses, wooden stanchions, as above described, must be placed at proper distances for each horse.

Stanchions, iron. (b) These may be used in place of wooden stanchions, and shall not be less than 2 inches in diameter, set in iron sockets above and below and fastened with $\frac{3}{4}$ -inch bolts. For horses the same number of iron stanchions are required as when wooden stanchions are used.

Hook bolts or clamps. (c) Hook bolts or clamps must be made of $\frac{3}{4}$ -inch wrought iron, with hook on outboard end and thread and nut on inboard end, to pass over and under rail and through outboard stanchion and set up on the

inside of same with a nut. These bolts may be double or single. If double, then no thread or nut is necessary, but the stanchion will lie shipped through it, thus double-hooking the rails. This will be found very useful where funnels or other deck fittings come in the way of beams passing from side to side of ship.

(d) Beams must be of good sound spruce or yellow pine lumber 3 by 6 inches, to run clear across the ship's beam where practicable. Should any house or deck fittings be in the way, then butt up closely to the same. These beams shall have a 1½ by 4 inch mortise to receive the tenon of each and every stanchion, and to take the same crown as deck of ship by springing down to shoulder of outside stanchions, and to be properly pinned or nailed to tenon and wedged tightly afterwards. The mortises shall be cut not less than 6 inches from outside ends of beams and a piece nailed on outside of same and trimmed off fair with beam ends to prevent splitting.

Diagonal braces from stanchions to beams. (e) Diagonal braces shall be fastened on each stanchion on both sides of same, running up to top side of beam and properly secured by well nailing to both stanchions and beam.

Headboards. (f) Headboards shall not be less than 2 by 10 or 3 by 8 inches, of good sound spruce or yellow pine lumber, and secured at every stanchion by ½-inch screw bolts passing through same and set up on same with a nut. Where headboards butt on the stanchions a piece of iron ½ inch thick and 3 inches square shall be placed over the boards like the butt strap. These headboards can be placed on either side of the stanchion. All headboards shall have 1½-inch holes bored through them at proper distances to tie the animal.

Headpipes. (g) In place of wooden headboards two wrought-iron pipes not less than 2 inches in diameter may be used, placed 5 inches apart. Said headpipes to be made continuous by having a wrought-iron threaded collar securely fastened on the end of each length of pipe into which the next length may be inserted or screwed. Both headpipes to be held in place by means of heavy wrought-iron straps bolted to each stanchion by four ½-inch bolts, the lower headpipe being fitted with movable clamps, holding a ring of suitable size to which cattle may be tied; said clamps to be set at the proper distance apart, in accordance with the regulations, and fastened to the pipe with screws.

Footboards. (h) Footboards shall be of wood and of the same dimensions as headboards, properly nailed or bolted to stanchions on the inside of same.

Division boards. (i) Division boards for cattle shall be of 2 by 8 inch sound spruce or yellow pine, fitted so as to be removable at any time and so arranged as to divide the animals into lots of 4, except at the ends of rows and when cattle weighing less than 1,000 pounds are carried, thus making compartments for this number all over the vessel. These division boards shall be fitted perpendicularly.

Division pipes. (j) In place of wooden division boards 3 wrought-iron pipes, not less than 2 inches in diameter, may be used, placed 6 inches apart, athwartship, set in iron sockets above and below and fastened with ½-inch bolts.

Division boards for horses. (k) Division boards for horses shall be not less than 2 by 9 inches by 8 feet, sound lumber, planed, and placed horizontally between the horses.

Flooring. (l) Where flooring is required it shall be of 1-inch spruce boards, laid fore and aft on ships with wooden decks. Iron decked ships shall be sheathed with 2-inch spruce or yellow pine or with 1-inch spruce; but if 1-inch lumber is used the foot locks shall be 3 by 4 and laid so that they will properly secure the 1-inch boards, thus preventing them from slipping and at the same time acting as foot locks by showing a surface of 2 by 4 inches. It is optional with the owners whether they permit sheathing to be used on their ships with wooden decks or whether they allow foot locks to be secured to the deck. But on iron decks it is absolutely necessary (if permanent foot locks are not down) to sheath them before putting down foot locks in order to fasten same. Cement, diagonally scored ½-inch deep, may be used on iron decks instead of wood sheathing if the foot locks be molded in same and bolted to the deck. If the flooring is raised on any of the decks, it shall not be less than 2 inches thick, with scantlings 2 by 3 inches thick laid athwartships on the deck, not over 18 inches apart, with 2-inch plank for flooring nailed to them.

Sheep pens. (m) When the pens for sheep are built for two tiers the flooring between the tiers shall be laid with tongued-and-grooved boards; the stanchions shall be 4 by 6 inch spruce lumber and shall be secured to the beams overhead by angle braces similar to cattle fittings. Outside planking for sheep pens shall be of 2-inch spruce or 1½-inch yellow pine lumber, secured to 4 by 6 inch spruce stanchions, with hook bolts similar to cattle fittings.

Foot locks. (n) Foot locks shall be of good sound spruce or yellow pine lumber or hard wood, size 2 by 4 inches, laid flat side down and fore and aft, placed 12 inches, 14 inches, 2 feet 2 inches, and 14 inches apart, the first one distant 12 inches from the inside of footboard. Where temporary fore-and-aft locks are used they shall be filled in athwartships opposite each stanchion, properly secured to sheathing or deck, and secured by a batten of spruce or yellow pine 2 by 3 inches thick to go over all, from stanchion to stanchion. Where permanent foot locks, securely bolted to iron decks, are used, the athwartship braces between foot locks, from stanchion to stanchion and batten, may be omitted when the stanchion is securely fitted in iron socket bolted to the deck. Uncovered iron decks may be arranged for cattle with athwartship foot locks, 2 by 4 inches, laid flat side down, and must be placed between the first and second, second and third, third and fourth fore-and-aft foot locks, to be at equal distances from each other, thus forming a space for each animal, and must be securely fastened to decks. In pens at each end of rows where five cattle are carried, there must be additional athwartship foot locks provided. When troughs are used fore-and-aft foot locks will be placed 17, 18, 22, and 18 inches apart. A space of 2 inches may be left between the ends of athwartship foot locks and fore-and-aft foot locks when the former are securely bolted to the deck. When fore-and-aft foot locks are permanent a 2 inch space shall be left between ends at the end of each section. Vessels now fitted with 3 by 4 inch foot locks will not be required to use 2 by 4 inch foot locks except when the former are replaced.

Outside planking. (o) All outside planking on open and closed rail ships must be properly laid fore and aft of ship and nailed to the backs of stanchions, as close as possible for the cold season, and for the warmer months the top-course planking shall be left off fore and aft of ship in order to allow a free circulation of air. Nothing less than 2-inch spruce or 1½-inch yellow pine is to be used for this purpose.

Shelter deck planking (p) The planks to form the shelter deck, which must be erected on all exposed decks, shall be laid with 2-inch sound spruce or yellow pine lumber or with 1½-inch sound spruce or yellow pine lumber if tongued and grooved, sufficient to cover cattle. These planks shall be laid as closely as possible and well nailed to the beams, thus making a good deck from which to work the ship's gear.

Nails. (q) No nails less than 20-penny shall be used in foot locks or where 2-inch material is used. Twelve-penny nails must be used in 1½-inch plank or under.

Cattle fittings over spar deck. (r) No cattle fittings shall be erected over permanent spar-deck fittings forward and aft of the midship section until permission has first been obtained from the Chief of Bureau of Animal Industry.

UNDER DECK.

Hatches over spar decks. 5. When the fittings on the spar deck are permanent, and hatches overhead are provided, the same regulations for ventilation shall apply as provided for under decks.

Alleyways. (a) Alleyways shall be of the same dimensions as those of the upper decks.

Stanchions. (b) Stanchions shall be of clear hard pine or spruce of equal quality, 4 by 6 inches, set up at proper distances from centers so that the 6-inch way of same shall stand fore and aft, and jammed in tight between the two decks, properly braced on head and from side to side of ship; this bracing shall be of 2 by 3 inch spruce or yellow pine and be properly butted against each stanchion. Where it is found impracticable to run these braces across ship by reason of hatches, etc., coming in the way, they shall be well braced from hatch coamings and from the obstructions which prevent running braces from side to side. The heads of these stanchions shall be braced fore and aft by 2 by 3 inch pieces well nailed on each stanchion and running fore and aft close up to the lower edge of the ship's beams, and butted at each end of compartment and against themselves, or chocked in underneath beam and well nailed to heads of stanchions. If upper and lower decks are wood, then the stanchions set up between decks may be secured by well cleating to each deck at heads and heels of same.

Headboards. (c) Headboards shall be of the same dimensions and same material as those on the upper deck and fastened and arranged in the same manner.

Footboards. (d) Footboards shall be of the same dimensions and same lumber as those of the upper deck and fastened in the same manner.

Division boards. (e) Division boards shall be of the same dimensions and material as those of the upper decks and fastened and arranged in the same manner.

Flooring. (f) Where ships have decks of wood it shall be optional with owners whether they have boards put down to protect decks or whether they allow the foot locks to be nailed to the ship's deck. (Permanent foot locks may be put down). If the decks are of iron, then wooden flooring must be laid either of a 2-inch spruce with 2 by 4 inch foot locks, or of 1-inch spruce with 3 by 4 inch foot locks, same as provided for upper decks. Iron decks may be covered with cement or fitted with athwartship foot locks, as provided for iron upper decks.

Foot locks. (g) Foot locks shall be arranged the same as provided for upper decks.

Troughs. (h) Suitable troughs may be built on the footboards, about 12 inches wide, when required for cattle, on either deck, by fastening foot-boards on outside of stanchions and fitting up on the inside. When it is desired to feed small grain or ground feed the trough shall be raised two inches above the deck to prevent the feed becoming wet. Removable troughs must be used for horses. Suitable troughs for grain and water must be provided on three sides of each sheep pen.

Casing for steering gear. (i) Suitable casing must be placed over the ship's steering gear when found necessary.

VENTILATION AND LIGHT.

Number of ventilators for each compartment. 6. Each under-deck compartment not exceeding 50 feet in length must have at least four bell-mouth ventilators of not less than 18 inches in diameter and with tops exceeding 7 feet in height above shelter deck, two situated at each end of the compartment. Compartments over 50 feet long must have additional ventilators of same dimensions or efficient fans.

Third-deck ventilators. (a) When it is desired to carry animals upon the third deck a special permit must be obtained from the inspector of the port. The vessel must be fitted as hereinbefore specified, lighted with electric lights, and properly ventilated. One set of ventilators should be trimmed to the wind and another set in the opposite direction. They must be tested previous to issuance of permit and kept in easy working order.

Light. (b) Suitable arrangements must be made to provide at all times sufficient light for the proper tending of all animals.

Engine room. (c) No animals should be loaded along the alleyways by engine room unless the sides of said engine room are covered by 1½-inch grooved-and-tongued lumber, making a 3-inch air space.

Ventilation for horses. (d) When horses are carried under decks, canvas bags of size of ventilator, provided with iron rings at the bottom, shall be attached to the down-take of fresh-air ventilators and reach to within 18 inches of the deck under foot.

HATCHES.

Animals and feed on hatches. 7. No cattle or sheep shall be loaded upon hatches on decks above animals nor upon third-deck hatches when animals are carried upon such deck, nor shall any merchandise, freight, or food for animals be loaded upon said hatches, but said hatches shall at all times be kept clear.

In loading animals on upper decks four of the largest hatches shall be kept free of animals—one hatch forward, one aft, and two amidships—so that the intervening space will be proportioned as equally as possible. Cattle or sheep may be placed upon hatches in excess of this number. Horses shall not be allowed upon any hatches.

Height of hatches and vertical space. (a) No cattle shall be loaded upon any hatch where the cofferings exceed 18 inches in height in center of hatch. There shall be not less than 6 feet vertical space between the beams overhead and the flooring placed on hatches under foot for horned cattle. Cattle without horns must be provided with 5 feet 6 inches clear vertical space between beams overhead and flooring underfoot.

FOOD AND WATER.

Water. 8. All vessels not provided with pipes for watering animals shall carry casks and hogsheds of not less than 400 gallons total capacity for each 100 head of cattle and horses, and an additional amount, in equal proportion, shall also be carried for sheep, and these shall be filled with fresh water before sailing and refilled as emptied. All water tanks for use of animals must be filled with good fresh water before sailing.

Condensers. (a) Each vessel shall carry water condensers which are in good working order and of sufficient capacity to provide 8 gallons of fresh cold water each twenty-four hours for each head of cattle in addition to the amount required by other animals on board and for other purposes.

Feed. (b) Not more than two days' feed for the animals shall be allowed to be carried on deck; this shall be properly covered and shall be the first feed used. All other feed shall be under hatches and, so far as possible, shall be placed in the holds contiguous to the animals on board.

ATTENDANTS.

Employment and character of attendants. 9. The employment of all attendants shall be subject to the approval of the owners or agents of steamships and of the inspector of the port, and men so employed shall be

reliable and signed as part of the ship's crew and under the control of the captain of said vessel. They shall be furnished with well-lighted and well-ventilated quarters—as good as the same accommodations furnished the crew of the ship and with bedding and table utensils. Experienced foremen shall be in charge of the animals, and not less than two-thirds of the attendants must be experienced men who have made previous trips with stock. The shippers of export animals or their agents shall make affidavit concerning the character of the attendants.

Cattle attendants. (a) There shall be one attendant for each 35 head of cattle upon steamers having water pipes extending the entire length of both sides of compartments, and upon steamers not so fitted there shall be one attendant to each 25 head of cattle shipped.

Pumping water by hand. (b) There shall also be additional help furnished by the captain of the vessel when water has to be pumped by hand.

Sheep attendants. (c) There shall be one man in charge of each 150 head of sheep during the winter season (October 1 to April 1), and one to each 200 sheep during the summer season.

Horse attendants. (d) For horses there shall be one attendant to each 25 head.

HEAD ROPES.

Size and kind. 10. Cattle shall be tied with $\frac{3}{4}$ -inch rope, which shall not be used more than once, and must be either manila, sisal, or jute.

Head ropes seized. (a) All head ropes returned to the United States shall be immediately seized and destroyed by the inspectors.

Halters, blankets, etc., disinfected. (b) All halters, blankets, stable utensils, feed bags, and feed troughs, if returned to this country, must be disinfected under supervision of inspector of the port, unless an affidavit is furnished by the captain of the vessel that the same have been disinfected, describing the manner of disinfection, or by the proper official at the port where the animals are unloaded.

FALSE DECKS.

Cleaning of false decks. 11. False decks upon which cattle are loaded must be removed and the manure and dirt cleaned from underneath before receiving another load of cattle.

INSPECTING, TAGGING, AND REST.

Rest for cattle and sheep. 12. No vessel shall be permitted to take on board any cattle or sheep unless the same have been allowed at least 12 hours actual rest in the yards at the port of embarkation before the vessel sails, nor until the loading of the other cargo has been completed.

Inspection during daylight. (a) All animals must remain a sufficient length of time in stables or yards during daylight at the port of embarkation before the vessel sails, for the purpose of inspection and tagging.

Rest for horses. (b) No vessel shall be permitted to take on board any horses having been shipped over 500 miles unless the same have been allowed at least 18 hours actual rest, in the stable or stables designated by the inspector for export horses at the port of embarkation, before the vessel sails; horses shipped less than 500 miles shall remain in such stables or yards as the inspector may designate not less than 6 hours for the purpose of inspection and rest. Horses shall not be placed upon steamers until the loading of the other cargo has been completed.

DEFECTIVE FITTINGS.

Replacing defective fittings.

13. The inspector may, in case he finds that any of the fittings are worn, decayed, defective in construction, or appear to be unsound, require the same to be replaced before he authorizes the clearance of the vessel.

LOADING.

Loading of animals and food.

14. The inspector or one of his deputies will supervise the loading of the animals and see that they are properly stowed and tied; that a sufficient amount of good, wholesome food is properly stowed, and that all the requirements of these regulations have been complied with. In case the regulations have not been complied with, he will immediately notify the Chief of the Bureau.

INJURED ANIMALS.

Injured animals slaughtered.

15. Animals suffering from broken limbs or other serious injuries during the voyage shall be slaughtered by direction of the captain of the vessel.

These regulations will take effect on and after November 1, 1899.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 47. Amendment to B. A. I. Order No. 24.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY.

Washington, D. C., October 21, 1899.

It is hereby ordered, That section 6 of B. A. I. Order No. 24, providing for the movement of cattle from the quarantined district described by said order and amendments thereto, from November 1 to December 31, inclusive, be amended as follows:

From November 1 to December 31, inclusive, cattle from said area destined to points within the States of Kansas and Missouri and the Territories of Arizona and New Mexico, and to points in the States of Texas and Tennessee and the Territory of Oklahoma outside of said quarantined district, and which are found free from infection upon inspection by officers of this Department, or by the properly authorized inspector of the State or Territory to which destined, may be moved to said localities outside of said quarantined district without restriction other than may be enforced by local regulations at destination. Cattle not inspected, or which have been inspected and found infected, are prohibited shipment to the noninfected section in the States and Territories above mentioned. All cattle from said quarantined district destined to points outside of the States and Territories above named may be shipped without inspection between November 1 and December 31, inclusive, and without restriction other than may be enforced by local regulations at point of destination.

And it is further ordered, That all stock pens which have been reserved for the use of cattle from the quarantined district, prior to November 1, next, shall not be used for receiving or storing cattle from the quarantined district which have been inspected and passed, nor for cattle originating outside of the quarantined district, except when such cattle are intended for immediate slaughter.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 48.]

ORDER CONCERNING THE MOVEMENT OF ANIMALS FROM DISTRICTS IN WHICH RABIES EXISTS.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY.

Washington, D. C., December 11, 1899.

In accordance with the act of Congress approved May 29, 1884, entitled "An act for the establishment of the Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation

of pleuropneumonia and other contagious diseases among domesticated animals," and with the act of Congress approved March 1, 1899, making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1900, notice is hereby given that a contagious disease of animals known as rabies or hydrophobia exists in the District of Columbia and in adjacent sections of the States of Maryland and Virginia; and the said District of Columbia and the counties of Montgomery and Prince George in Maryland and Alexandria and Fairfax in Virginia are hereby declared an infected district; and

It is hereby ordered, That no animals of any species which are affected with said disease, or which have been bitten by rabid animals, be transported, driven, or allowed to stray from the District of Columbia into Maryland or Virginia or from Maryland or Virginia into the District of Columbia; and the movement of all dogs is hereby prohibited from the District of Columbia into Maryland and Virginia, and from the above-mentioned counties of Montgomery and Prince George in Maryland and Alexandria and Fairfax in Virginia into the District of Columbia:

Provided, however, That such prohibition shall not apply to dogs which are securely muzzled so that they can not bite, and which are kept so securely muzzled when in the streets and other public places for sixty days after they have been taken from the District of Columbia into Maryland or Virginia or from the above-mentioned counties of Maryland or Virginia into the District of Columbia.

Persons violating this order will be subject to prosecution, and if convicted will be liable to the penalty imposed in section 7 of the act of Congress approved May 29, 1884, while all dogs brought or allowed to stray across the boundary lines of said District and counties in violation of this order will be summarily seized.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 49.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,

OFFICE OF THE SECRETARY,

Washington, D. C., December 16, 1899.

To managers and agents of railroads and transportation companies of the United States, stockmen, and others:

In accordance with section 7 of the act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuropneumonia and other contagious diseases among domestic animals," and of the act of Congress approved March 1, 1899, making appropriation for the Department of Agriculture for the fiscal year ending June 30, 1900, you are hereby notified that a contagious and infectious disease known as splenic, or Southern, fever exists among cattle in the following described area:

1. All that country lying south, or below, a line beginning at the northwest corner of the State of California; thence east, south, and southeasterly along the boundary line of said State of California to the southeastern corner of said State; thence southerly along the western boundary line of Arizona to the southwest corner of Arizona; thence along the southern boundary lines of Arizona and New Mexico to the southeastern corner of New Mexico; thence northerly along the eastern boundary of New Mexico to the southern line of the State of Colorado; thence along the southern boundary lines of Colorado and Kansas to the southeastern corner of Kansas; thence southerly along the western boundary line of Missouri to the southwestern corner of Missouri; thence easterly along the southern boundary line of Missouri to the western boundary line of Dunklin County; thence southerly along the said western boundary to the southwestern corner of Dunklin County; thence easterly along the southern boundary line of Missouri to the Mississippi River; thence northerly along the Mississippi River to the northern boundary line of Tennessee at the northwest corner of Lake County; thence easterly along said boundary line to the northeast corner of Henry County; thence in a northerly direction along the boundary of Tennessee to the northwest corner of Stewart County; thence in an easterly direction along the northern boundary of Tennessee to the southwestern corner of Virginia; thence northeasterly along the western boundary line of Virginia to the northernmost point of Virginia; thence southerly along the eastern boundary line of Virginia to the northeast corner of Virginia where it joins the southeastern corner of Maryland, at the Atlantic Ocean.

2. Whenever any State or Territory located above or below said quarantine line,

as above designated, shall duly establish a different quarantine line, and obtain the necessary legislation to enforce said last-mentioned line strictly and completely within the boundaries of said State or Territory, and said last above-mentioned line and the measures taken to enforce it are satisfactory to the Secretary of Agriculture, he may, by a special order, temporarily adopt said State or Territorial line.

Said adoption will apply only to that portion of said line specified, and may cease at any time the Secretary may deem it best for the interest involved, and in no instance shall said modification exist longer than the period specified in said special order; and at the expiration of such time said quarantine line shall revert without further order to the line first above described.

Whenever any State or Territory shall establish a quarantine line for above purposes differently located from the above described line, and shall obtain by legislation the necessary laws to enforce the same completely and strictly, and shall desire a modification of the Federal quarantine line to agree with such State or Territorial line, the proper authorities of such State or Territory shall forward to the Secretary of Agriculture a true map or description of such line and a copy of the laws for enforcement of same, duly authenticated and certified.

3. From the 1st day of January, 1900, no cattle are to be transported from said area south, or below, said Federal quarantine line above described to any portion of the United States above, north, east, or west of the above-described line, except as hereinafter provided.

4. Cattle from said area may be transported, by rail or boat, for immediate slaughter, and when so transported the following regulations must be observed:

(a) When any cattle in course of transportation from said area are unloaded above, north, east, or west of this line to be fed or watered, or for other purposes, said cattle shall be placed in pens or yards set apart for infected cattle, and no other cattle shall be admitted thereto.

(b) On unloading said cattle at their points of destination, chutes, alleyways, and pens, sufficiently isolated, shall be set apart to receive them, and no other cattle shall be admitted to said chutes, pens, and alleyways; and the regulations relating to the movement of cattle from said area, prescribed by the cattle sanitary officers of the State where unloaded, shall be carefully observed. The cars or boats that have carried said stock shall be cleansed and disinfected as soon as possible after unloading and before they are again used to transport, store, or shelter animals or merchandise.

(c) All cars carrying cattle from said area shall bear printed placards, the letters of which shall be plain and not less than $1\frac{1}{2}$ inches in height, to be affixed by the railroad company hauling the same, stating that said cars contain Southern cattle, and each of the waybills, conductor's manifests, and bills of lading of said shipments by cars or boats shall have a note plainly written or stamped upon its face with a similar statement. Whenever any cattle have come from said area and shall be reshipped from any point at which they have been unloaded to other points of destination, the cars carrying said animals shall bear similar placards with like statements, and the waybills, conductor's manifests, or bills of lading be so stamped. At whatever point these cattle are unloaded they must be placed in separate pens, to which no other cattle shall be admitted.

(d) No boat having on board cattle from said district shall receive on board cattle from outside of said district. Cattle from said district shall not be received on board when destined to points outside of said district where proper facilities have not been provided for transferring the said cattle from the landing to the stock yards and slaughterhouses without passing over public highways, unless permission for such passing is first obtained from the local authorities.

(e) The cars and boats used to transport such animals, the chutes, alleyways, and pens used during transportation, and at points of destination, shall be disinfected in the following manner:

Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime or saturating it with a 5 per cent solution of 100 per cent carbolic acid; or, if not disinfected, it may be stored where no cattle can come in contact with it during the period from February 1 to November 15 of each year.

Wash the cars and the feeding and watering troughs with water until clean.

Saturate the entire interior surface of the cars and the fencing, troughs, and chutes of the pens with a mixture made of $1\frac{1}{2}$ pounds of lime and one-quarter pound 100 per cent straw-colored carbolic acid to each gallon of water; or a solution made by dissolving 4 ounces of chloride of lime to each gallon of water may be used; or disinfect the cars with a jet of steam under a pressure of not less than 50 pounds to the square inch.

5. Cattle from the Republic of Mexico may be admitted into the United States, after inspection according to law, as follows:

Cattle free from splenic, or Texas, fever, and from contact therewith during the three months preceding such inspection, and which have been grazed in a locality free from infection of such fever, may be admitted into any part of the United States. If destined to points in the noninfected area, a special permit must be obtained from an inspector of the Bureau of Animal Industry, said permit being issued according to the regulations of said Bureau; the cattle for which said permit is issued must not be driven through the infected area, nor be unloaded in any part thereof except at such a point as may be duly designated by an order issued by this Department; if shipped in infected cars, or unloaded in the infected area, except as above stated, they will be subject to the regulations concerning infectious cattle.

6. Notice is hereby given that cattle infested with the *Boophilus bovis*, or Southern cattle tick, disseminate the contagion of splenic, or Southern, fever (Texas fever); therefore cattle originating outside of the district described by this order, or amendments thereof, and which are infested with the *Boophilus bovis* ticks shall be considered as infectious cattle and shall be subject to the rules and regulations governing the movement of Southern cattle.

7. Stock-yard companies receiving cattle infested with said ticks shall place such cattle in the pens set aside for the use of Southern cattle, and transportation companies are required to clean and disinfect all cars and boats which have contained the same, according to the requirements of this Department.

8. Inspectors are instructed to see that disinfection is properly done, and to report instances of improper disinfection. It is expected that transportation and stock-yard companies will promptly put into operation the above methods.

All prior orders conflicting herewith are hereby revoked.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 50.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF TEXAS—1900.

U. S. DEPARTMENT OF AGRICULTURE,

OFFICE OF THE SECRETARY,

Washington, D. C., December 19, 1899.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of Texas has located a quarantine line as follows:

Beginning at the intersection of the southern boundary of New Mexico with the international boundary line at the Rio Grande River; thence southeasterly along the said international boundary line to the southwest corner of the county of Pecos; thence following the western boundary of Pecos County to the southeast corner of Reeves County; thence following the boundary line between the counties of Pecos and Reeves to the Pecos River; thence southeasterly, following the Pecos River, to the northwest corner of Crockett County; thence east along the northern boundary of Crockett and Schleicher counties to the southeastern corner of Irion County; thence north along the eastern boundary of Irion County to the northeast corner of said county; thence north to the southern boundary of Coke County; thence west to the southwest corner of Coke County; thence north along the western boundary of Coke County to the southern boundary of Mitchell County; thence east to the southeastern corner of Mitchell County; thence north along the eastern boundary of Mitchell County to the northeast corner of said county; thence east along the southern boundaries of Fisher and Jones counties to the southeast corner of Jones County; thence north along the eastern boundary of Jones County to the northeast corner of said county; thence east along the southern boundary of Haskell County to the southeast corner of said county; thence north along the western boundary lines of Throckmorton and Baylor counties to the northwest corner of Baylor County; thence east along the southern boundary of Wilbarger County to the southeast corner of said county; thence north along the eastern boundary of Wilbarger County to the Red River; thence continuing in a northwesterly direction along the course of said river and the northern boundary of Texas to the southeast corner of Greer County.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Texas to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Texas by this Department for the period beginning on January 1, 1900, and ending December 31, 1900, in lieu of the quarantine line described in the order of December 16, 1899, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 51.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE TERRITORY OF OKLAHOMA—1900.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 19, 1899.

In accordance with the regulations concerning cattle transportation issued by this Department, the Territory of Oklahoma has located a quarantine line described as follows:

Beginning on the Red River at the southeastern corner of the county of Greer thence northerly following the course of the North Fork of the Red River to its intersection with the southern boundary line of Roger Mills County along the western boundary lines of the Apache, Comanche, and Kiowa Indian reservations thence east along the southern boundary lines of Roger Mills and Washita counties to the intersection with the boundary line of the Wichita Indian Reservation on the Washita River; thence north along the western boundary line of said reservation to its northwest corner at its intersection with the Canadian River in the county of G; thence in a southeasterly direction along the course of said river and the northern boundary of the Wichita Indian Reservation to the northeast corner of said reservation; thence easterly along the southern boundary of Canadian County to the southeast corner of said county; thence north along the eastern boundary lines of Canadian and Kingfisher counties to the northeastern corner of Kingfisher County; thence east along the southern boundary of O (Garfield) County to the southeast corner of said county; thence north along the eastern boundary of O (Garfield) County to the northeast corner of said county; thence east along the southern boundary line of Kay County to the west line of the Ponca Indian Reservation; thence north along the west line of said reservation to the northwest corner of said reservation; thence east along the northern boundary of the Ponca Indian Reservation to the Arkansas River; thence in a northerly direction following the course of said river to its intersection with the thirty-seventh parallel of north latitude at the southern boundary line of Kansas.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the Territory of Oklahoma to enforce said quarantine line, therefore the above quarantine line is adopted for the Territory of Oklahoma by this Department for the period beginning on January 1, 1900, and ending December 31, 1900, in lieu of the quarantine line described in the order of December 16, 1899, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 52.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF TENNESSEE—1900.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 19, 1899.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of Tennessee has located a quarantine line, described as follows:

Beginning on the Mississippi River at the southeast corner of the State of Missouri at the western boundary of Tennessee; thence southerly along the western boundaries of the counties of Dyer and Lauderdale to the southwest corner of Lauderdale County on the Mississippi River; thence easterly along the northern boundary of Tipton County to the northeast corner of said county; thence northerly and easterly along the western and northern boundaries of Haywood County to the northeast corner of said county; thence easterly along the northern boundary lines of Madison, Henderson, and Decatur counties to the northeast corner of Decatur County; thence south along the eastern boundary of Decatur County to the northwest corner of Wayne County; thence easterly along the northern boundary lines of Wayne and Lawrence counties to the northeastern corner of Lawrence County; thence south along the western boundary of Giles County to the southwestern corner of said county; thence east and north along the southern and eastern boundaries of said county to the northwestern corner

of Lincoln County; thence easterly along the northern boundaries of Lincoln and Moore counties to the northeast corner of Moore County; thence north along the western boundary lines of Coffee and Cannon counties to the northwest corner of Cannon County; thence easterly to the northeast corner of Cannon County; thence south to the intersection of the eastern boundary line of Cannon County with the boundary of Warren County; thence easterly and northerly along the northern boundary lines of Warren, White, and Cumberland counties to the northeast corner of Cumberland County; thence southerly along the eastern boundary lines of Cumberland, Rhea, and James counties to the northwest corner of Bradley County; thence northerly and southeasterly along the northern boundary lines of Bradley and Polk counties to the northeast corner of Polk County; thence south along the eastern boundary line of Polk County to the southeast corner thereof at the southwestern corner of North Carolina.

That portion of the quarantine line for the State of Virginia, described in the order of December 19, 1899 (B. A. I. Order No. 54), beginning at the southwestern corner of Virginia (Lee County) and extending east along the southern boundary line of Virginia to the southwestern corner of Grayson County, is hereby suspended during the enforcement of the above line for the State of Tennessee.

And whereas said quarantine line, as above set forth, is satisfactory to this Department and legislation has been enacted by the State of Tennessee to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Tennessee by this Department for the period beginning on January 1, 1900, and ending December 31, 1900, in lieu of the quarantine line described in the order of December 16, 1899, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 53.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF VIRGINIA—1900.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 19, 1899.

In accordance with the regulation concerning cattle transportation issued by this Department, the State of Virginia has located a quarantine line, described as follows:

Beginning at the boundary line of Virginia at its southwestern corner (Lee County); thence east along the southern boundary of Virginia to the southwestern corner of Patrick County; thence northerly along the western boundaries of Patrick and Franklin counties to the western boundary of Bedford County; thence in a southeasterly and northeasterly direction along the southern and eastern boundaries of Bedford County to the James River; thence following the James River to the southeastern corner of Charles City County; thence northerly and easterly along the western and northern boundaries of James City County to the western boundary of Gloucester County at the York River; thence southerly and northerly along the southern and eastern boundaries of Gloucester County to the northeastern corner of said county; thence easterly and southerly along the northern and eastern boundaries of Mathews County to the southeastern point of said county; thence south to the northern boundary of Elizabeth City County; thence westerly and northerly along the boundaries of Elizabeth City and Warwick counties to the James River; thence southeasterly along the course of the said river to the northwest corner of Norfolk County; thence south along the western boundary of said county to its intersection with the northern boundary of North Carolina; thence east along the southern boundaries of Norfolk and Princess Anne counties to the Atlantic Ocean.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Virginia to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Virginia by this Department for the period beginning on January 1, 1900, and ending December 31, 1900, in lieu of the quarantine line described in the order of December 16, 1899, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 54.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF NORTH CAROLINA—1900.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 19, 1899.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of North Carolina has located a quarantine line described as follows:

Beginning at the southwest corner of the county of Cherokee; thence east along the southern boundary lines of the counties of Cherokee, Clay, Macon, Jackson, Transylvania, and Henderson, to the southeast corner of the county of Henderson; thence northerly along the eastern boundary line of Henderson County to the northeast corner thereof; thence westerly to the eastern boundary line of Buncombe County; thence northerly along the eastern boundary line of Buncombe County to the southern boundary line of Yancey County; thence northeasterly along the southern boundary line of Yancey County to the southern portion of Mitchell County; thence northeasterly along the southern and eastern boundary line of Mitchell County to the southern boundary line of Watauga County; thence easterly along the southern boundary line of Watauga County to the western boundary line of Wilkes County; thence following the western and northern boundary line of Wilkes County to the western portion of Surry County; thence northeasterly along the eastern boundary line of Alleghany County to its intersection with the northern boundary line of the State of North Carolina.

That portion of the quarantine line for the State of Virginia, described in the order of December 19, 1899 (B. A. I. Order No. 53), beginning at the southwestern corner of Grayson County and extending east along the southern boundary line of Virginia to the southeastern corner of said county, is hereby suspended during the enforcement of the above line for the State of North Carolina.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of North Carolina to enforce said quarantine line, therefore the above quarantine line is adopted for the State of North Carolina by this Department for the period beginning on January 1, 1900, and ending December 31, 1900, in lieu of the quarantine line described in the order of December 16, 1899, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 55.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF CALIFORNIA—1900.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 19, 1899.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of California has located a quarantine line as follows:

Beginning on the Pacific coast, where the southern boundary line of Marin County connects with the Pacific Ocean; thence easterly and northerly along the southern and eastern boundary lines of Marin and Sonoma counties to the intersection of Sonoma and Solano counties; thence following the western, northern, and eastern boundary lines of Solano County to the Sacramento River; thence northerly along the eastern boundary line of Yolo County to its intersection with the boundary line of Sutter County; thence easterly along the southern boundary lines of Sutter and Placer counties to the intersection with the western boundary line of El Dorado County; thence southerly and easterly along the southern boundary line of El Dorado County to the intersection with the western boundary line of Alpine County; thence in a southerly direction along the western boundary lines of Alpine, Mono, and Inyo counties to the southwestern boundary of Inyo County; thence east along the southern boundary of Inyo County to its intersection with the eastern boundary line of the State of California.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of California to enforce

said quarantine line, therefore the above quarantine line is adopted for the State of California by this Department for the period beginning on January 1, 1900, and ending December 31, 1900, in lieu of the quarantine line described in the order of December 16, 1899, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 56.]

REGULATIONS FOR THE INSPECTION AND QUARANTINE OF HORSES, NEAT CATTLE, SHEEP, AND OTHER RUMINANTS, AND SWINE IMPORTED INTO THE UNITED STATES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 28, 1899.

Authority under which made. In pursuance of sections 7, 8, and 10 of the act of Congress entitled "An act providing for the inspection of meats for exportation, and prohibiting the importation of adulterated articles of food or drink, and authorizing the President to make proclamation in certain cases, and for other purposes," approved August 30, 1890, and of the act of Congress making appropriations for the Department of Agriculture, approved March 1, 1899, the following regulations are hereby prescribed for the inspection and quarantine of horses, neat cattle, sheep, and other ruminants, and swine imported into the United States on and after March 1, 1900. All previous regulations for such inspection and quarantine shall become void after that date.

Ports of import and quarantine and inspection stations.

1. With the approval of the Secretary of the Treasury, the following-named ports are hereby designated as quarantine stations, and all horses, cattle, sheep, and other ruminants, and swine imported into the United States and which are subject to quarantine and inspection must be entered through said stations, viz:

On the Atlantic seaboard: Boston, Mass.; New York, N. Y., and Baltimore, Md. On the Pacific seaboard: San Diego, Cal. Along the boundary line between the United States and Mexico: Nogales, Ariz.; El Paso, Eagle Pass, Laredo (port of Corpus Christi, Tex.), and Brownsville, Tex. Along the border or boundary line between the United States and British Columbia and Canada: Vanceboro (port of Bangor, Me.), and Houlton, Me.; Beecher Falls (port of Newport, Vt.), Island Pond (port of Newport, Vt.), Newport, Richford (port of Burlington, Vt.), and St. Albans, Vt. (port of Burlington, Vt.); Rouses Point (port of Plattsburg, N. Y.), Ogdensburg, Cape Vincent, Charlotte (port of Rochester, N. Y.), Niagara Falls, and Buffalo, N. Y.; Detroit, Port Huron, and Sault Ste. Marie, Mich. (port of Marquette, Mich.); Pembina, N. Dak., and Port Townsend, Wash.

The following-named stations are designated for the entry of animals which are subject to inspection only, viz: Eastport, Calais, and Fort Fairfield, Me. (port of Houlton, Me.); Derby Line (port of Newport, Vt.) and North Troy, Vt. (port of Newport, Vt.); Mooers Junction (port of Plattsburg, N. Y.), Chateaugay (port of Plattsburg, N. Y.), Malone, Fort Covington (port of Plattsburg, N. Y.), Waddington (port of Ogdensburg, N. Y.), Morristown (port of Ogdensburg, N. Y.), and Alexandria Bay, N. Y. (Port of Cape Vincent, N. Y.).

Animals subject to inspection. Diseases requiring quarantine.

2. The word "animals" when used in these regulations refers to and includes all or any of the following kinds: Horses, asses, and mules; neat cattle, sheep, and other ruminants; and swine.

Under the word "horses" will be included asses and mules; and under the word "sheep" will be included all ruminants except cattle. The words "contagious diseases" when used in these regulations include and apply to all or any of the following diseases: Glanders and farcy, *maladie du coït*, distemper, anthrax, contagious pleuropneumonia, Texas, or splenic, fever, tuberculosis, actinomycosis, foot-and-mouth disease, rinderpest, variola, foot rot, scab, hog cholera, swine plague, and erysipelas.

Certificate accompanying horses.

3. (a) All horses imported into the United States from any part of the world, except as otherwise provided for the countries of North America, shall be accompanied with a certificate from the local authority of the district in which said animals have been for one year next preceding the date of shipment, stating that no glanders and farcy, distemper, *maladie du coït*, or any other disease contagious to horses has existed in said district for the past year. They shall also be required to pass a careful veterinary inspection at the port of entry.

Certificate accompanying cattle, sheep, and other ruminants. (b) All cattle, sheep, and other ruminants imported into the United States from any part of the world, except as hereinafter provided for the

countries of North America, shall be accompanied with a certificate from the local authority of the district in which said animals have been for one year next preceding the date of shipment, stating that no contagious pleuropneumonia, foot-and-mouth disease, anthrax, rinderpest, or any other disease contagious to cattle has existed in said district for the past year.

Certificate accompanying swine. (c) All swine imported into the United States from any part of the world, except as otherwise provided for the countries of North America, shall be accompanied with a certificate similar to the one required for cattle, sheep, and other ruminants, relating to the existence of foot-and-mouth disease, hog cholera, swine plague, and erysipelas.

Animals shall be accompanied by certificate and affidavit. (d) All such animals shall also be accompanied with an affidavit by the owner, stating that said animals have been in the district where purchased

for one year next preceding the date of sale, and that no contagious disease affecting the species of animals imported has existed among them, nor among any animals of the kind with which they have come in contact, for one year last past, and that no inoculation has been practiced among said animals for the past two years. Also by an affidavit from the importer or his agent supervising the shipment, stating that they have not passed through any district infected with contagious diseases affecting said kind of animals; that they have not been exposed in any possible manner to the contagion of any of said contagious diseases, and that the animals, when not driven, have been shipped in clean and disinfected cars and vessels direct from the farm where purchased.

Certificate and affidavit to be presented to collector of customs. (e) The foregoing certificate and affidavits must accompany said animals and be presented to the collector of customs at the port of entry, and by

him be delivered to the inspector of the Bureau of Animal Industry stationed at said port, to allow them to be imported into the United States.

Period of quarantine. 4. All neat cattle imported into the United States from any part of the world, except as provided for the countries of North and Central America, shall be subject to a quarantine of ninety days, counting from the date of shipment; this date of shipment to be the date of clearance of the vessel bringing the animals to the United States. Sheep and other ruminants and swine from any part of the world, except North and Central America, shall be subject to a quarantine of fifteen days, counting from the date of arrival at the quarantine station: *Provided*, That cattle and sheep imported for slaughter at the port of landing may be imported without quarantine, but shall be subject to such restrictions as the Chief of the Bureau of Animal Industry, after causing an inspection to be made, may consider necessary in each case for guarding the domestic animals of the United States from contagion.

Tuberculin test for cattle. 5. All cattle over six months old imported into the United States after March 1, 1900, which are subject to quarantine and except as otherwise provided, shall be tested with tuberculin after their arrival at quarantine. All cattle so tested and which show a reaction shall be disposed of as provided in section 10 of these regulations.

IMPORTATIONS FROM CANADA INTO THE UNITED STATES.

Affidavit accompanying animals. 6. All animals imported into the United States from the Dominion of Canada must be accompanied by an affidavit made by the owner or importer, declaring clearly the purpose for which said animals are imported, viz: whether for breeding purposes, for milk production, for work, for grazing, feeding, or slaughter, or whether they form part of settlers' effects, or whether they are horses entered for temporary stay, as provided by these regulations. Said affidavit must be presented to the collector of customs at the port of entry, who will decide whether the animals are entitled to entry under these regulations, and who will notify the inspector of the Bureau of Animal Industry in all cases where the regulations require an inspection to be made.

Horses. (a) Horses for breeding, racing, show, and sale purposes, for grazing or for work, must be inspected at port of entry. Those belonging to Indian tribes and settlers, and those used in connection with stock raising (cow ponies) or mining, and those for temporary stay at points along the frontier, not exceeding two weeks, whether for pleasure, driving, or teaming, are not required to be inspected. Horses will be admitted in bond at any port of the United States without inspection for export from any port of the United States; they shall,

however, be subject to inspection when exported from ports at which this Department has inspectors stationed.

Cattle. (b) Cattle for breeding purposes, milk production, grazing, or feeding must be inspected, and must be accompanied by a certificate signed by a Canadian official veterinarian, stating that no contagious disease affecting cattle, except tuberculosis and actinomycosis, has existed in the district in which the animals have been kept for six months preceding the date of importation. The owner must present an affidavit that said certificate refers to the cattle in question.

Tuberculin test. (c) A certificate for cattle over six months old for breeding purposes and for milch cows must also show that they have been submitted to the tuberculin test and found free from tuberculosis, giving the date of testing, with the chart of reaction, and a description of the cattle, with age and markings.

Quarantined when not accompanied by affidavits and certificates. (d) All cattle imported for breeding, milk production, grazing, or feeding, when not accompanied by the required affidavits and certificates,

must be detained in quarantine for one week, at the expense of the owner or importer, under the supervision of the inspector in charge. During this detention a rigid inspection will be made, and cattle over six months old for breeding and milk production will be tested with tuberculin. Animals found free from disease at the end of that period will be released.

(e) Cattle for slaughter shall be inspected.

Belonging to Indian tribes and settlers. (f) Those forming part of settlers' effects or belonging to Indian tribes will be admitted through any port without inspection or certification.

Inspection may be required for all animals. (g) Any animals may be required to be inspected at the port of entry, and any cattle showing symptoms of tuberculosis may be subjected to the tuberculin test, upon instruction from the Chief of the Bureau of Animal Industry.

Shipped in bond. (h) Cattle in bond for export will be admitted without inspection at any of the ports named in section 1 in transit to and for export from Portland, Me.; Boston, Mass.; New York, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Newport News and Norfolk, Va.

Sheep. (i) All sheep imported into the United States for breeding, grazing, or feeding must be inspected, and must be accompanied by a certificate signed by a Canadian official veterinarian, stating that no contagious disease affecting sheep has existed in the district in which the animals have been kept for six months preceding the date of importation. The owner or importer must present an affidavit that said certificate refers to the sheep in question.

Quarantined when not accompanied by affidavits and certificates. (j) Sheep for breeding purposes, grazing, or feeding, when not accompanied by the required affidavits and certificates, must be detained in quarantine

for one week at the expense of the owner or importer, under the supervision of the inspector in charge. During this detention a rigid inspection will be made. Sheep found free from disease at the end of this period will be released.

When not inspected. (k) Sheep for grazing or feeding, if accompanied by the required affidavits and certificates, need not be unloaded for inspection.

For immediate slaughter. (l) Sheep for immediate slaughter, and those belonging to Indian tribes or forming part of settlers' effects, will be admitted through any port without inspection or certification.

Shipped in bond. (m) Sheep in bond for export will be admitted without inspection at any of the ports mentioned in section 1 in transit to and for export from Portland, Me.; Boston, Mass.; New York, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Newport News and Norfolk, Va.

Swine. (n) All swine shall be subjected to inspection, except those belonging to Indian tribes or forming part of settlers' effects, which will be admitted at any port without inspection. Swine imported for breeding purposes, grazing, or feeding shall be accompanied by an official veterinary certificate, as indicated for cattle and horses. The owner or importer must present an affidavit that said certificate refers to the swine in question. Swine not accompanied by affidavits and certificates will be subject to the same quarantine as provided for sheep.

Cars to be cleaned and disinfected. (o) The railroad cars used in the transportation of animals specified by these regulations must be thoroughly cleaned and disinfected before said animals are placed therein. All litter

from previous shipments must be removed, and the car whitewashed with lime and carbolic acid, 1 pound of 100 per cent straw-colored commercial carbolic acid to 5 gallons of lime wash. Unless this regulation is complied with, Canadian animals will not be allowed entry into the United States, and animals from the

United States will not be admitted into Canada. Shippers should see that cars are properly cleaned and disinfected before animals are loaded.

IMPORTATIONS FROM MEXICO INTO THE UNITED STATES.

Horses. 7. (a) Horses for breeding, racing, show, and sale purposes, for grazing or for work, must be inspected at the port of entry. Those belonging to Indian tribes and settlers, and those used in connection with stock raising (cow ponies) or mining, and those for temporary stay at points along the frontier, not exceeding two weeks, whether for pleasure, driving, or teaming, are not required to be inspected. Horses will be admitted in bond at any port of the United States without inspection for export from any port of the United States. They shall, however, be subjected to inspection when exported from ports at which this Department has inspectors stationed.

Cattle. (b) All cattle imported into the United States from Mexico are subject to inspection. Cattle for breeding purposes, milk production, grazing, or feeding must be accompanied by an affidavit made by the owner, stating that said cattle have been in the district from which shipped for six months next preceding the date of importation, and that no contagious disease affecting cattle has existed among them nor among any animals of the kind with which they have come in contact for six months last passed; also by an affidavit made by the importer or his agent supervising the shipment, stating that they have not passed through any district infected with contagious diseases affecting cattle; that they have not been exposed in any possible manner to the contagion of any contagious disease, and that the animals when not driven have been shipped in cleaned and disinfected cars and vessels direct from the farm or ranch where purchased.

Quarantined when not accompanied by affidavit. (c) All cattle imported for breeding purposes, milk production, grazing, or feeding, when not accompanied by the required affidavits, must be

detained in quarantine for one week at the expense of the owner or importer, under the supervision of the inspector in charge. During this detention a rigid inspection will be made.

For immediate slaughter. (d) Cattle for immediate slaughter may be admitted, when found free from disease, upon inspection only, and when so entered said cattle shall be subject to the regulations pertaining to the transportation of cattle from the district infected with Texas, or splenic, fever.

Sheep. (e) Sheep for breeding purposes, grazing, or feeding must be accompanied by an affidavit made by the owner of said sheep, stating that they have been in the district from which shipped for six months next preceding the date of importation, and that no contagious disease affecting sheep has existed among them, nor among other animals of the kind with which they have come in contact for six months last past, also by an affidavit made by the importer or his agent, supervising the shipment, stating that they have not passed through any district infected with contagious diseases affecting sheep; that they have not been exposed in any possible manner to the contagion of any contagious disease, and that the animals, if not driven, have been shipped in cleaned and disinfected cars and vessels direct from the farm or ranch where purchased. Sheep for breeding purposes, grazing, or feeding not accompanied by the required affidavits must be detained in quarantine for one week at the expense of the owner or importer, under the supervision of the inspector in charge.

Swine. (f) All swine shall be accompanied with affidavits similar to those required for cattle and sheep, relating to the existence of contagious disease affecting swine, and when not accompanied by said affidavits shall be detained in quarantine for one week, as provided for cattle and sheep.

Consigned to slaughtering centers. 8. Animals admitted from North American countries for immediate slaughter must be consigned to some recognized slaughtering center, and must be slaughtered within two weeks from date of entry. All animals admitted for export will be subject to inspection at the port of export.

IMPORTATIONS IN GENERAL.

Permits for import animals. 9. Any person contemplating the importation of animals other than horses from any part of the world, except the countries of North and Central America, must first obtain from the Secretary of Agriculture two permits, one stating the number and kind of animals to be imported, the port and probable date of shipment, which will entitle them to clearance papers on presentation to the American consul at said port of shipment;

the other, stating the port at which said animals are to be landed and quarantined, and the approximate date of their arrival, and this will assure the reception of the number and kind specified therein at the port and quarantine station named, at the date prescribed for their arrival, or at any time during three weeks immediately following, after which the permit will be void. These permits shall in no case be available at any port other than the one mentioned therein. Permits must be in the name of the owner of, or agent for, any one lot of animals. A quarantine release will be given each owner for the number and kind of animals belonging to him which are discharged from quarantine, and this release will be a certificate of fulfillment of quarantine regulations. In case an importation of animals is owned by more than one person, a release will be issued to each owner covering the animals which belong to him. Permits will be issued to quarantine at such ports as the importer may elect, so far as facilities exist at such port, but in no case will permits for importation at any port be granted in excess of the accommodations of the Government quarantine station at such port. United States consuls should give clearance papers or certificates for animals from their districts intended for exportation to the United States only upon presentation of permits as above provided, with dates of probable arrival and destination corresponding with said permits, and in no case for a number in excess of that mentioned therein. When such shipments originate in the interior of a foreign country, these permits should be submitted to the consul of that district and through the forwarding agent to the consul at the port of embarkation.

Disposal of animals found diseased. 10. All animals imported into the United States, and which are subject to inspection, shall be carefully inspected by an inspector of the Bureau of Animal Industry, and all animals found to be free from disease and not to have been exposed to any contagious disease, shall be admitted into the United States, subject to the provisions for quarantine as established in section 4, except as otherwise provided. Whenever any animal upon arrival at the port of entry or in the quarantine station is found to be affected with a contagious disease or to have been exposed to such disease said animal, and all animals that have been in contact with or exposed to said animal, shall be placed in special quarantine. All animals so quarantined, either on arrival at port of entry or after reaching the quarantine station, shall be at once reported by the inspector to the Chief of the Bureau of Animal Industry, who will direct whether or not said animals quarantined shall be appraised and slaughtered, as provided by section 8 of the act approved August 30, 1890.

Vessels disinfected. 11. In case of imported animals proving to be infected or to have been exposed to infection, such portions of the cargo or the vessel on which they have arrived as have been exposed to these animals or their emanations shall be subjected, under the direction of the inspector of the Bureau of Animal Industry, to disinfection in such manner as may be considered by said inspector necessary before it can be landed. In all cases the parts of the vessel that have been occupied by imported animals shall be cleaned and disinfected with lime wash under the supervision of the inspector of the port.

Articles accompanying animals. 12. No litter, fodder, or other aliment, nor any ropes, straps, chains, girths, blankets, poles, buckets, or other things used for or about the animals, and no manure, shall be landed from any vessel excepting under such regulations as the inspector shall provide.

Movement from vessels to quarantine stations. 13. On moving animals from the ocean steamer to the quarantine grounds they shall not be unnecessarily passed over any highways, but must be placed on cars at the wharves or removed to the cars on a boat which is not used for conveying other animals. If such boat has carried animals within three months, it must be first cleaned and then disinfected under the supervision of the inspector, and after the conveyance of the imported animals the boat must be disinfected in the same manner before it may be again used for the conveyance of animals. When passage upon or across the public highway is unavoidable in the transportation of animals from the place of landing to the quarantine grounds, it must be under such careful supervision and restrictions as the inspector may in special cases direct.

Special platforms and chutes. 14. The platforms and chutes used for loading and unloading imported animals shall be reserved for such cattle, or shall be cleansed and disinfected as above before being used for such imported cattle.

Special cars reserved. 15. The railway cars used in the transportation of animals to the quarantine grounds shall be either cars reserved for this exclusive use or box cars not otherwise employed in the transportation of animals.

or their fresh products, and after each journey with animals to the quarantine grounds they shall be disinfected by thorough cleansing and disinfection under the direction of the inspector.

Arrival at quarantine station. 16. While animals are arriving at the quarantine stations, or leaving them, all quarantined stock in the yards adjoining the alleyways through which they must pass shall be rigidly confined to their sheds. Animals arriving by the same ship may be quarantined together in one yard and shed, but those coming on different ships shall in all cases be placed in separate yards.

Gates of station. 17. The gates of the quarantine stations and of all yards of said stations shall be kept locked, except when animals are entering or leaving quarantine.

Attendants and animals allowed. 18. The attendants on animals in particular yards are forbidden to enter other yards and buildings, unless such are occupied by stock of the same shipment with those under their special care. No dogs, cats, or other animals, except those necessarily present, shall be allowed in the quarantine grounds.

Record kept by inspector. 19. The allotment of yards shall be under the direction of the inspector in charge, who shall keep a register of animals entered, with description, name of owner, name of vessel in which imported, date of arrival and release, and other important particulars.

Water; manure. 20. The inspector shall see that water is regularly furnished to the stock. Special places for depositing manure from yards and stables shall be provided, and no manure shall be removed from the quarantine station until the release of the animals from which produced.

Disposal of milk. 21. Milk from quarantined animals shall not be used by any persons other than those in charge of such animals nor fed to any other animals than those within the same lot until ten days after the date of quarantine.

Food and attendants to be paid for by owner. 22. Food and attendants must be provided by the owners of the stock quarantined, and said owner or his agent shall give satisfactory assurance to the

inspector at the time of admission to quarantine that such provision will be made. The employees of such owners shall keep the sheds and yards clean to the satisfaction of the inspector, and be subject to the rules of the station. If for any cause the owners of the quarantined stock refuse or neglect to supply food and attendants, the inspector will furnish the same. The food and care so furnished shall be at the expense of the owners of the stock, and the charges therefor will be a lien on the animals. After the expiration of one-third of the quarantine period, if payment has not been made, the owners of the animals will be notified by the inspector that if said charges be not immediately paid or satisfactory arrangements made for the payment, the inspector will sell the stock at public auction at the expiration of the period of quarantine, to pay the expense of food and care during that period. Notice of the sale will be published once a week for two weeks in a newspaper published in the county where the station is located; the day of sale will be at the expiration of the quarantine period, and at such place as may be designated by the inspector. From the proceeds of the sale an amount equal to the charges for food and care of the animals and the expenses of the sale will be covered into the United States Treasury, and the remainder, if any, will be held for the owners, but if not called for at the end of six months from the date of sale, this balance will be deposited in the United States Treasury.

Smoking forbidden. 23. Smoking is strictly forbidden within any quarantine inclosure.

Persons not allowed on quarantine station. 24. No visitor shall be admitted to the quarantine station without special written permission from the inspector. Butchers, cattle dealers, and their employees are especially excluded.

Public sales not allowed. 25. No public sale shall be allowed within the quarantine grounds.

Record of temperatures. 26. The inspector shall, in his daily rounds, so far as possible, take the temperature of each animal, commencing with the herds that have been longest in quarantine and ending with the most recent arrivals, and shall record such temperatures on lists kept for the purpose. In passing from one herd to another he shall invariably wash his thermometer and hands in a weak solution (1 to 40) of carbolic acid.

Appearance of disease in quarantine. 27. In case of the appearance of any disease that is diagnosed to be of a contagious nature, the inspector shall notify the Chief of the Bureau of Animal Industry, who shall visit the

station personally or send an inspector, and on the confirmation of the diagnosis the herd shall be disposed of according to the gravity of the affection.

Disinfecting quarantine station. 28. The yard and shed in which such disease shall have appeared shall be subjected to a thorough disinfection. Litter and fodder shall be burned. Yards, fences, sheds, utensils, and other appliances shall be disinfected as the Chief of the Bureau of Animal Industry may direct.

Animals rigidly confined. 29. In case of the appearance of any contagious disease, the infected herd shall be rigidly confined to its sheds, where disinfectants shall be freely used, and the attendants shall be forbidden all intercourse with the attendants in other yards and with persons outside the quarantine grounds.

30. The inspector in charge shall see that the above rules and regulations are complied with.

JAMES WILSON, *Secretary.*

LAWS FOR THE CONTROL OF CONTAGIOUS DISEASES OF ANIMALS.

ARKANSAS.

AN ACT to locate and establish a district cattle quarantine line in the State of Arkansas.

Be it enacted by the General Assembly of the State of Arkansas:

Boundaries defined.

SECTION 1. That there shall be established by the State of Arkansas a district cattle quarantine line, described as follows:

Beginning at the northwest corner of Benton County and running thence south along the boundary line of this State to the southwest corner of Washington County; thence in an easterly direction following the southern boundary lines of Washington, Madison, Newton, Searcy, and Stone counties to the northwest corner of Cleburne County; thence south along the line between Cleburne and Independence counties to the southwest corner of Independence County; thence east along the southern boundary of Independence County to the west boundary of Jackson County; thence north along the line between Jackson and Independence counties to the Lawrence County line, where it is crossed by Black River; thence north with meanderings of Black River to the Missouri line.

Line open when.

SEC. 2. Said line shall be open to the free and unrestricted transfer of cattle, by driving or otherwise, across said line from and after the fifteenth day of December of each year, and shall continue open until the first day of March the succeeding year, after which date it shall be unlawful to drive or transport any and all cattle across said line; provided, that this act shall not interfere with the shipment of cattle by cars which are being transported across the State to other markets or places of destination outside of the State or Territory included in said quarantine district.

Penalty.

SEC. 3. *Be it further enacted*, That any person or persons found to be engaged in driving or transporting any cattle whatever across said line, or any person or persons found aiding or abetting in the driving or transporting of such cattle across said line during the period intervening between the first day of March and the fifteenth day of December in each year, except as provided for in section two (2) of this act, be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum of not less than two hundred dollars (\$200) nor more than five hundred dollars (\$500) for each offense.

Who shall make arrests.

SEC. 4. And to give full force and effect to this act, it shall be the duty of any peace officer of this State who apprehends any person or persons violating this act, to have said party or parties arrested and brought before the proper authorities for a speedy trial; and, *provided further*, that in the prosecution of offenders under this act by said peace officer, they shall not be required to give bond for cost.

Cattle may be impounded.

SEC. 5. And any officer finding any cattle which has [have] been driven across said line in violation of this act shall, upon such finding, seize and impound such cattle and hold them as security against all fines and costs of prosecution of the said owner of said cattle for the violating of this act.

Compensation for driving back.

SEC. 6. *Be it further enacted*, That it shall be the duty of any officer, upon finding such cattle, as soon as costs of prosecution, fine, etc., are settled, to drive said cattle back across said quarantine line as near the route over which they came as possible. Said officer to be allowed the sum of five dollars (\$5) per day for such labor, and said sum to be paid by the parties violating said act.

Repealing clause.

SEC. 7. That this act shall take effect and be in full force on and after its passage, and that all laws and parts of laws in conflict herewith be, and the same are hereby repealed.

Approved March 9, 1899.

IDAHO.

AN ACT to suppress contagious and infectious diseases of sheep; the office of State sheep inspector and of deputy sheep inspectors, to provide for the appointment of the same and fix their compensation; making the doing of certain acts a crime and providing for the punishment of the same, and for other purposes.

Be it enacted by the Legislature of the State of Idaho:

Appointment of Inspector. SECTION 1. The office of sheep inspector for the State of Idaho is hereby created. It shall be the duty of the Governor, within twenty days from and after the passage of this act, to appoint some suitable, capable, and discreet person and practical sheep grower to fill said office.

Salary of Inspector. SEC. 2. The said sheep inspector shall receive as full compensation for his services a salary of four hundred dollars (\$400) per annum, to be paid as the salary and fees of other State officers are paid.

Duties of Inspector. It shall be the duty of the State sheep inspector to have general supervision over his deputies appointed under the provisions of this act, and to aid, counsel, and advise with such deputies, and generally to

Duties and expenses of Inspector. enforce the provisions of this act. The said sheep inspector shall have the same power within the entire State as the deputies appointed by him have in their respective districts, and where the services of the State sheep inspector are demanded in a county or district other than that in which he resides, to settle differences between sheep men and any deputy, it shall be the duty of the said State sheep inspector to go and adjust such differences, and the said party or parties demanding such services shall pay the actual traveling expenses of said State sheep inspector.

Term of office and bond. SEC. 3. Said State sheep inspector shall hold his office for the term of two years, and until his successor is appointed and qualified, unless sooner removed by the Governor. Before entering upon the discharge of his duties as such officer, he shall file an official bond in the sum of two thousand dollars (\$2,000) conditioned for the faithful performance of the duties of his office, in form and manner as other official bonds of State officers.

Appointment of deputies. SEC. 4. Such State sheep inspector shall have power, and it shall be his duty to divide each county or counties into districts, and to appoint for such districts one or more deputy inspectors, as in his judgment may seem necessary. Such deputies shall hold office until their successors are appointed and qualified, unless sooner removed by the State sheep inspector. They shall be practical sheep men who, before entering into the duties of their office, shall take an oath of office as required of county officers, and shall

Bond of deputies. give a bond to the State of Idaho in the penal sum of two thousand dollars (\$2,000), conditioned for the faithful performance of the duties of such deputy sheep inspector (such bond shall be approved by the State sheep inspector) and be placed on file in his office. Such deputy shall be subject to removal by the State sheep inspector, when in his judgment it shall seem necessary to do so.

Inspection lines established. SEC. 5. It shall be the further duty of the State sheep inspector, with the assistance of the deputies appointed by him in the several districts, to create what shall be known as "inspection lines," in each county or district where it shall be deemed necessary between the summer and winter ranges. And shall cause a notice containing a careful description

Publication of notice. of said inspection line in each county, to be published for three weeks in some newspaper published in said county and upon the last publication thereof, due notice of the location of such inspection line shall be deemed to have been given. The expense of such publication shall be charged against the county, where such notice is given, payable as other charges. *Provided*, That this section shall not be so construed as to prohibit other stock crossing said inspection line and occupying the range inclosed by said lines.

Certificate required. SEC. 6. It shall be unlawful for any person, persons, company, or corporations owning, controlling, or managing any band or herd of sheep to drive or herd or cause to be driven or herded across such line going to or returning from the summer range without first having his or her sheep inspected and obtaining the sheep inspectors certificate showing such sheep to be

Penalty. free from scab and sound. Any person, persons, company, or corporation violating this section shall be guilty of a misdemeanor and shall upon conviction, be punished by [a] fine of two hundred and fifty dollars (\$250), and such fines shall constitute a first lien upon said sheep so driven or herded and shall be collected as provided for in section 14 of this act.

Power to administer oaths. SEC. 7. The State sheep inspector and his deputies appointed under this act shall have the power to administer oaths as far as the same may be necessary in the proper performance of their duties, and any person who shall, contrary to said oath, state as true any material thing which he knows to be false is guilty of perjury.

When to inspect. SEC. 8. It shall be the duty of at least one deputy inspector in each county or district to be designated by the State sheep inspector to personally examine all sheep and bands of sheep in his county or district thereof between the first day of March and the first day of June of each year and again between the first day of September and the first day of November of each year; and to the owners and persons in charge of herds found to be clean, he shall issue a certificate stating such fact, which certificate shall permit such herd to pass into and through any and all counties in this State so long as they shall remain clean and free from disease; such deputy is required to examine any band or bands of sheep at any time that he may be called upon to do so at the request of one or more sheep growers in writing stating that such sheep are affected or infected with some infectious or contagious disease and that there is imminent and immediate danger of the spread of such disease. *Provided*, That upon examination such sheep are found to be clean, the person or persons making such complaint shall pay the expenses of such examination, which may be recovered in a civil action therefor; but, in case such inspector, upon making such examination, finds said sheep diseased, he shall forthwith issue his order quarantining said sheep, and they shall be dealt with as provided in section 9 hereof.

Infected sheep; dipping. SEC. 9. Whenever upon an examination of any bands or herds of sheep kept or herded in any county of the State of Idaho, the deputy sheep inspector of such county or district thereof shall find such sheep or any portion of them, affected or infected with the scab or scabies, or any other infectious or contagious disease, the entire band or herd shall be considered as infected and treated as such and he shall immediately quarantine the same and forthwith notify the owner or person in charge of said sheep, in writing, to dip said sheep twice for said disease within the period of thirty days from said notice; the first dipping not to exceed fifteen days from the receipt of said notice and the second dipping to be within the period of from eight to twelve days from the first dipping, and also during such period to keep such sheep free from contact with other sheep by such means as he shall specify until after the second dipping.

Inspector to superintend dipping. SEC. 10. Such deputy sheep inspector or competent persons appointed by him, shall superintend all dipping provided for in this act and shall have full and complete power to enforce and designate the strength, heat, and length of time such sheep shall be in the bath; and all expenses incurred in so doing, including a compensation of five dollars (\$5) for every day or part of a day in which said deputy sheep inspector or person appointed by him may be engaged in dipping said sheep, shall become and is hereby made a first lien upon said sheep for a period of ten days, unless sooner paid, and, if the same is not paid within such time, he shall sell so many of said sheep as may be necessary to realize sufficient money to pay said sum due him, together with the costs and charges of the sale including five dollars (\$5) per day for each day he holds said sheep. Such sale shall be made and conducted in the same manner as sales of personal property on execution out of the district court.

Penalty. SEC. 11. The owner or owners or controller of any sheep or the deputy sheep inspector or person appointed by him who shall fail to dip said sheep as required by the provisions of this act shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred dollars (\$100) or more than two hundred and fifty dollars (\$250) or by imprisonment in the county jail for a period of not less than two months or more than six months, or by both such fine and imprisonment.

Not required to dip, when. SEC. 12. No person, persons, company, corporation, or association within the State of Idaho shall be required to dip his or their bands of sheep between the first day of December and until such time as he or they can shear said sheep in the following spring, nor shall they be required to dip a band or bands of ewes, or any part of them, in which there are ewes with lambs, at any time between the fifteenth day of March and the fifteenth day of May following, of any year; but they must be held in quarantine and kept separate and apart from sound sheep, and the owner, owners, or controllers shall be responsible for all damages as stated in this act, to be enforced and recovered as herein provided for.

Hand-dressing, or spotting. SEC. 13. It shall also be the duty of said deputy sheep inspector to require the owner, owners, or controllers of sheep while held in quarantine during the period mentioned in the above section to spot or hand-dress all sheep in their band or bands that show any scab or any contagious or infectious disease, with some reliable medicine; and such deputy sheep inspectors shall have the power to enforce such hand-dressing or spotting during the period above referred to the same as he has the power to enforce dipping at any other period of the year as provided in this act.

Improper dipping; costs. SEC. 14. Should any owner or person in charge of any sheep found to be infected upon examination by the deputy sheep inspector fail or refuse to dip said sheep or should do so in an improper manner, it shall be the duty of said deputy sheep inspector to seize said sheep and to dip the same. And when the same shall have been dipped, he shall notify the owner or person in charge of the amount of the costs, charges, and expenses due for the same. If such owner or person in charge shall refuse for the period of ten days after receiving said notice to pay the same, together with all further costs, charges, and expenses of holding said sheep, it shall be the duty of the said deputy to sell so many of said sheep as may be necessary to pay the same and all costs and expenses of such sale. Such sale shall be made and conducted as sales of personal property on execution out of the district court.

Compensation of deputies. SEC. 15. The deputy sheep inspectors in the several counties or districts, as provided in this act, shall receive five dollars (\$5) per day for every day or part of a day spent in the performance of his duty, to be paid by the owner or owners of the sheep examined and to be enforced as a lien against the sheep so examined, as provided in section 14 of this act.

Inspection of import sheep. SEC. 16. Any person, persons, company, corporation, or association driving, herding, or cause to be driven or herded any sheep from any other State into the State of Idaho shall immediately, upon crossing the State line, notify the deputy sheep inspector of that district, and cause said sheep to be inspected by him, within two miles of the point where said sheep crossed said line.

Certificate upon import sheep. SEC. 17. It shall be the duty of the deputy sheep inspector, upon receipt of such notice of sheep having crossed the State line in his district, at once to inspect the same. And if said sheep are found to be sound, he shall issue a certificate to the owner or person in charge stating that said sheep are clean, and thereafter so long as said sheep remain in this State they shall in all respect be under the provisions of this act. Any person, or persons violating any of the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred dollars (\$100) or more than three hundred dollars (\$300). When sheep are brought into this State in violation of this section, it shall be the duty of the deputy sheep inspector of the district or county wherein said sheep may be, immediately to seize the same and hold them and to file a complaint in a court of competent jurisdiction charging the owner or person in charge of said sheep with a violation hereof, and upon the conviction of the defendant in said action, the said deputy shall (unless all fines, costs, and charges be immediately paid) sell in the same manner as sales of personal property on execution out of the district court, so many of said sheep as may be necessary to pay the costs and charges of making such sale including the compensation due him, together with the fine imposed in such action.

And a certified copy of the judgment in such action shall be his sufficient warrant for doing the same.

Unlawful to import diseased sheep. SEC. 18. It is unlawful for any person, persons, company, corporation, or association, to drive or herd or cause to be driven or herded into the State of Idaho from any other State any sheep infected with the scab or any contagious or infectious disease.

Penalty. Every person so offending shall be guilty of a felony and shall be punished by a fine of not less than one thousand dollars (\$1,000) or more than five thousand dollars (\$5,000) for each and every offense or by imprisonment in the State prison for not less than one year nor more than five years.

And the said sheep shall be seized, held, and sold if such fine be not paid in the manner provided for in section 17 hereof.

Traveling permit. SEC. 19. Any person, persons, company, or corporation, or association within the State desiring to move his or their sheep which are not sound or are infected by scab or other infectious or contagious disease shall first obtain from the deputy sheep inspector a traveling permit. Such per-

mit shall only be granted for the purpose of moving said sheep to the nearest suitable point where there is an available dipping works or where one can be constructed, at which place said sheep shall be dipped.

Such sheep shall travel to said point over a route designated by the deputy sheep inspector.

Notice to be given. The person or persons moving said sheep shall first notify all parties herding sheep along or over said route that the infected sheep have to travel of the time they will pass over said route.

Damages. And any person, persons, company, corporation, or association, injured or damaged by reason of the moving of said sheep shall be entitled to recover from the person, persons, company, corporation, or association moving the same in a civil action the amount of damages direct and consequential. *Provided*, however, no party shall be entitled to recover damages who shall voluntarily herd or cause to be herded any sheep on quarantined ground. Said sheep so voluntarily herded shall be considered as scabby without inspection and shall be treated as provided in section 9 hereof.

Penalty. Any person or persons violating any of the provisions of this section shall be guilty of a felony and upon conviction thereof shall be punished by a fine of not less than three hundred dollars (\$300) or more than five hundred dollars (\$500) or by imprisonment in the State prison for not less than two months or more than six months or by both such fine and imprisonment.

Penalty. SEC. 20. Any deputy sheep inspector granting a permit allowing sheep to travel, without at the time having first examined the sheep, shall be guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not less than one hundred dollars (\$100) and not more than two hundred and fifty dollars (\$250).

Penalty for suppressing information. SEC. 21. Any person or persons owning or having under their control sheep or bands of sheep which have become infected with the scab or other infectious or contagious disease, for a period of fifteen days without reporting the fact to the deputy sheep inspector of such county or district thereof where such sheep are situate, in writing, shall be guilty of a felony and shall upon conviction thereof be punished by a fine of not less than three hundred dollars (\$300) or more than five hundred dollars (\$500), or by imprisonment in the State prison for not less than two months or not more than six months or by both such fine and imprisonment. Such fine if not immediately paid shall be collected, together with all costs and charges, by seizure and sale of the sheep as provided in section seventeen hereof.

Unlawful occupancy; penalty. SEC. 22. It shall be unlawful for any person, persons, company, corporation or association to drive or cause to be driven any sheep into any sheep corral the property of another, without first having obtained in writing the consent of the owner or person having control or custody of such sheep corral. Any person, persons, company, corporation or association violating any of the provisions of this section shall be guilty of a felony and upon conviction thereof shall be punished by a fine of not less than two hundred dollars (\$200) or more than five hundred dollars (\$500), or imprisonment in the State prison for not less than six months or by both such fine and imprisonment.

Responsibility as owner. SEC. 23. In any action or proceeding, civil or criminal, arising under this act, any and all persons having any interest in sheep or controlling the same, and concerning which said action or proceeding is had, shall be deemed the owner of said sheep, and shall be liable jointly and severally for such violation. Any herder or shepherd or other person in charge of

Shepherds to give information. sheep, may be sworn to give any deputy sheep inspector any and all information as to the condition of the sheep in his charge to the best of his knowledge, on being requested so to do by the deputy and upon refusing to do so shall be guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not less than twenty-five dollars (\$25) or more than one hundred dollars (\$100) or by imprisonment in the county jail for not less than two months or more than six months, or by both such fine and imprisonment.

Records of brands and marks. SEC. 24. It shall be the duty of each deputy sheep inspector appointed under this act to keep a book in which he shall record as complete a description as practicable of the marks and brands with which each person in his county or district marks or brands his sheep, and the owners of sheep shall report in writing to such deputy sheep inspector

Record of prosecutions. to make up and keep such records; said deputy sheep inspectors are also required to keep a book, in which they shall record the names of all persons prosecuted for violations of this act, together with a description of the particular offense charged against him or them, the name of the court in which the prosecution was had, and the result of such prosecution, giving the amount of fines where fines are imposed.

Report to be made. And on the first day of January of each year each deputy sheep inspector appointed under the provisions of this act shall make a report to the State sheep inspector, which report shall contain a true and correct copy of his record as contained in the books required by him to be kept under the provisions of this act, which report shall be placed on file in the office of the State sheep inspector.

Unlawful transportation. SEC. 25. It shall be unlawful for any person, persons, company, corporation, or association owning, controlling, or managing a ferryboat, toll bridge, car, steamboat, or other things used for transportation in the State of Idaho to allow any sheep to be loaded thereon, unless the party in charge of said sheep shall first produce a certificate from a deputy sheep inspector appointed under this act that said sheep are free from scab, scabies, and other infectious or contagious disease.

Penalty. Any violation of this section shall be deemed a misdemeanor and punishable by a fine of not less than one hundred dollars (\$100) or more than two hundred and fifty dollars (\$250).

Moving without inspection; penalty. Any person, persons, company, corporation, or association owning, controlling, or managing sheep who shall unload such sheep from any car, ferryboat, steamboat, toll bridge, or other things used for transportation and move them onto the ranges of Idaho for grazing or other purposes or drive or cause to be driven upon the public highways of this State such sheep, without first having them inspected by a deputy sheep inspector shall be guilty of a misdemeanor and shall be punished by a fine of not less than one hundred dollars (\$100) and not more than three hundred dollars (\$300), and such fine shall be collected by seizure and sale of said sheep as provided in section 17 of this act.

Treatment as in section 9. If such sheep are found to be clean the deputy sheep inspector shall issue a certificate stating such fact. But if they or any portion of them are found to be infected with scab or any other contagious or infectious disease they shall be treated for the same as described in section 9 of this act. And the person, persons, company, corporation, or association owning [owning], controlling, or managing such sheep shall be guilty of a felony and shall be punished as provided in section 18 hereof.

Stray sheep; penalty. SEC. 27. If any person, persons, company, or corporation in driving or herding any sheep should get into their herd any stray sheep, they must within fifteen days after discovering the fact notify the owner thereof; and if the owner is unknown, he or they shall forthwith notify the deputy sheep inspector of such county, giving the number of such sheep and the brands of each; and [any] person, persons, company, corporation, or association violating the provisions of this section shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not less than fifty dollars (\$50) or more than two hundred dollars (\$200).

Powers of arrest. SEC. 28. All deputy sheep inspectors are hereby given the power, and it is made their duty, to arrest and bring before a justice of the peace or other court having jurisdiction of the same, all persons found violating any of the provisions of this act, where a complaint shall be filed by such deputy sheep inspector, either upon his own knowledge or upon information of such violation; whereupon a hearing shall be had as in other like criminal cases; and such deputy sheep inspectors are hereby vested with the same authority to arrest and to require aid, in the execution of their said office as sheriffs and their deputies of the several counties of the State; *Provided*, That the provisions of this act requiring the deputy sheep inspectors to prosecute for a violation of the provisions hereof shall not be construed so as to prevent such prosecution from being commenced and prosecuted by other persons as criminal actions are commenced and prosecuted in other cases.

Compensation in arrests. The deputy sheep inspectors, as full compensation for their services in prosecutions under this act, shall be allowed the same fees and mileage allowed the sheriff for like services, to be paid as other claims against the county.

Repealing clause. SEC. 29. All acts and parts of acts in conflict with this act are hereby repealed.

SEC. 30. Whereas an emergency exists therefor, this act shall be in force and take effect from and after its passage.

Approved February 25, 1899.

AN ACT establishing quarantine against diseased sheep, prescribing the duties of governor in relation thereto, and providing penalties for the infraction of its provisions.

Be it enacted by the legislature of the State of Idaho,

Established quarantine. SECTION 1. Whenever the governor of the State of Idaho has reasons to believe that scab or any other infectious disease of sheep has become epidemic in certain localities in any other State or Territory, or that conditions exist that render sheep likely to convey disease, he must thereupon by proclamation designate such localities and prohibit the importation from them of any sheep into the State, except under such restrictions as, after consultation with the State sheep inspector, he may deem proper.

Penalty. Any person or corporation who, after publication of such proclamation, receives in charge any such sheep from any of the prohibited districts and transports, conveys or drives the same to and within the limits of any of the counties of this State is punishable by fine not exceeding one thousand dollars (\$1,000) nor less than two hundred dollars (\$200), and is liable for all damages that may be sustained by any person by reason of the importation of such prohibited sheep.

Deputy inspector to be notified. SEC. 2. On issuing such proclamation the owner or persons in charge of any sheep being shipped into Idaho against which quarantine has been declared must forthwith notify the deputy inspector of the county into which such sheep first come of such arrival, and such owner or persons in charge must not allow any sheep so quarantined to pass over or upon any public highway or upon the ranges occupied by other sheep or within five miles of any corral in which sheep are usually corralled until such sheep have first been inspected, and any person failing to comply with the provisions of this section is punishable as provided in section 1 of this act, and is liable for all damages sustained by any person by reason of the failure to comply with the provisions of this section.

SEC. 3. Whereas an emergency exists, this act shall be in force from and after its passage.

Approved March 13, 1899.

KENTUCKY.

AN ACT to prevent the spread in this Commonwealth of the disease called glanders.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

Owner must kill glandered animals. SECTION 1. When it is made to appear to the satisfaction of the county judge or any justice of the peace of any county in this Commonwealth that any animal within his county is diseased with glanders, it shall be the duty of the county judge or justice of the peace to notify the owner and require him to kill and bury it; and before the animal or animals are killed the county judge, with a justice of the peace or two justices of the peace, shall cause the animal to be valued.

Valuation fixed and certified. the valuation not to exceed \$30 for any one animal, and the valuation of said animal or animals, together with the fact of its destruction, shall be certified by the two justices or the county judge to the county court, together with the name of the owner, and spread upon the records of the court. A certified copy of said order, under the seal of the county, shall be delivered to the owner, and upon its presentation to the county court the county judge may order the amount certified to be paid out of the county funds in which county said disease appears. *Provided, further,* That if the animal is diseased with glanders and the owner should refuse to destroy the animal on the demand of the county judge or any justice, he shall be subject to a fine of not less than \$100 nor more than \$500, to be enforced by indictment, etc.

Repealing clause. SEC. 2. All acts and parts of acts in conflict with this act are hereby repealed.

Emergency. SEC. 3. As the disease called glanders is now known to exist in several of the counties in this Commonwealth, and a great damage and danger is thereby threatened, an emergency exists and is hereby declared, and this act shall take effect from and after its passage.

Approved April 29, 1897.

MASSACHUSETTS.

AN ACT relative to animals affected with contagious diseases.

Be it enacted, etc., as follows:

Inspection to be permitted. SECTION 1. Section two of chapter one hundred and seventy-eight of the acts of the year eighteen hundred and ninety-seven is hereby amended by striking out the whole of said section and inserting in place thereof the following: Section 2. Every owner or person having charge of an animal in said city shall permit any health commissioner or health inspector of said city to examine such animal from time to time, and for that purpose to enter upon any premises upon which the animal is kept. The board of health of said city, when convinced that any animal is affected with either of the diseases aforesaid, shall notify the owner or person having charge of the animal to permit the animal to be killed or otherwise disposed of. Any health inspector of said city who is also a doctor of veterinary medicine, when of the opinion that any animal within said city is affected with or had been exposed to infection from any animal having either of said diseases, shall notify the owner or person having the charge of such animal to isolate such animal in such manner as the board of health of said city shall prescribe, or to permit such animal to be taken and isolated by said board.

SEC. 2. This act shall take effect upon its passage.
Approved April 22, 1899.

AN ACT relative to infectious diseases among domestic animals and to establish a new board of cattle commissioners.

Be it enacted, etc., as follows:

Appointment of cattle commissioners. SECTION 1. The governor, with the advice and consent of the council, shall appoint a board of cattle commissioners of not more than three members whose terms of office shall begin on the first day of June in the year eighteen hundred and ninety-nine, and who shall hold office as follows: One of said members for the term of three years, one for the term of two years, and one for the term of one year, and thereafter one of said members shall be appointed annually for the term of three years. The compensation of said commissioners shall not exceed five dollars a day for each day of actual service, in addition to their traveling expenses necessarily incurred. Any member of the board may be removed by the governor and council, who may revoke the commissions of the entire board when in their judgment the public safety may permit. Vacancies in the board by expiration of terms of service or otherwise shall from time to time be filled by appointment by the governor with the consent of the council. The board of cattle commissioners as now constituted shall cease to exist on the thirty-first day of May in the year eighteen hundred and ninety-nine, and the duties now devolving by law upon said board shall thereafter be performed by the board created by this act.

Clerk; compensation. SEC. 2. The board of cattle commissioners may appoint a clerk to keep the record of its doings, who shall receive such compensation, not exceeding the sum of five hundred dollars a year, as it shall determine.

Record reported to legislature. SEC. 3. The board of cattle commissioners shall keep a full record of its doings and report the same to the legislature on or before the tenth day of January in each year, unless an earlier report is required by the governor. An abstract of its report shall be printed in the annual report of the State board of agriculture.

Power to issue regulations. SEC. 4. The board of cattle commissioners shall have power to make from time to time orders and regulations concerning the extirpation, prevention, and suppression of contagious diseases among domestic animals, or concerning the care and treatment or destruction of animals affected with, or which have been exposed to, any contagious disease.

Regulations to be issued. SEC. 5. The board of cattle commissioners shall from time to time make orders and regulations concerning the inspection and examination of animals, the quarantine and killing of animals affected with, or which have been exposed to, contagious disease, the burial or other disposal of their carcasses, and the cleansing and disinfecting of districts, buildings, or places where such contagion exists or has existed. Said board shall from time to time make and prescribe forms for records of inspectors, certificates of exam-

inations, notices and orders of quarantine, orders for killing and burial, and all returns to be made by inspectors which are provided for under the provisions of this act.

Quarantine stations. SEC. 6. The board of cattle commissioners may establish hospitals or quarantine stations, with proper accommodations, wherein, under prescribed regulations, animals selected by such commissioners may be confined and treated for the purpose of determining the characteristics of a specific contagion, and the methods by which it may be disseminated or destroyed, and it may direct inspectors to enforce and carry into effect all regulations made from time to time for that purpose.

Agents and assistants. SEC. 7. The board of cattle commissioners may appoint from time to time officers, agents, and assistants whose appointment is necessary or expedient to carry out the purposes of this act, and may remove any and all of the persons so appointed. All such officers, agents, and assistants shall have the power and authority conferred upon inspectors under the provisions of section twenty-eight of this act, and shall receive such compensation as the board shall determine.

Disposing of animals. SEC. 8. When the board of cattle commissioners or any of its members or agents, by examination of a case of contagious disease among domestic animals, is convinced that the public good requires it, the board, commissioner, or agent shall cause such animal or animals to be securely isolated, or shall cause it or them to be killed without appraisal or payment. Such order for killing shall be issued in writing by the board or any of its members, and may be directed to an inspector or other person, and shall contain such direction as to the examination and disposal of the carcass, and the cleansing and disinfecting of the premises where such animal was condemned, as the board or commissioner shall deem expedient. A reasonable sum may be paid out of the

Payment for animals not diseased. treasury of the commonwealth for the expense of such killing and burial. If it shall subsequently appear, upon postmortem examination or otherwise, that such animal was free from the disease for which it was condemned, a reasonable sum therefor shall be paid to the owner by the commonwealth. Whenever any cattle condemned as afflicted with the disease of tuberculosis are killed under the provisions of this section the full value thereof at the time of condemnation, not exceeding the sum of forty dollars for any one animal, shall be paid to the owner out of the treasury of the commonwealth if such animal has been owned within the State six months continuously prior to its being killed: *Provided, however,* That such person shall not have, prior thereto, in the judgment of the board, by willful act or neglect, contributed to the spread of tuberculosis; but such decision on the part of the commissioners shall not deprive the owner of the right of arbitration as hereinafter provided.

Regulations to conform to those of Bureau of Animal Industry.

SEC. 9. Said board may make and issue rules and regulations for the guidance of inspectors of animals and provisions in the inspection of meat which shall conform with the rules and regulations of the United States Bureau of Animal Industry for the inspection of meat for export and for interstate commerce.

Examination under oath. SEC. 10. Said board may examine under oath all persons believed to possess knowledge of material facts concerning the existence or dissemination, or danger of dissemination, of contagious diseases among domestic animals, or concerning any other matter within the provisions of this act, and each member of said board shall have, for any purpose of this act, all the powers vested in justices of the peace by chapters one hundred and fifty-five and one hundred and sixty-nine of the public statutes and acts in amendment thereof, to take depositions, to compel witness to attend and testify before

Expenses of witnesses. said board, and to administer oaths. The fees for such witnesses for attendance and travel shall be the same as for witnesses before the superior court. All costs and expenses incurred in procuring the attendance of such witnesses shall be allowed and paid by the commonwealth. Copies of the records of said board, or of any regulation or order issued by it or by any of its members under the provisions of this act, when duly certified by the secretary of said board, and any certificate by said secretary of the issuing, recording, delivering, or publishing of any such orders or regulations under the provisions of section thirteen of this act, shall be competent evidence of such fact in any tribunal.

Duty of sheriffs and police officers. SEC. 11. Every cattle commissioner and inspector shall have power to call on sheriffs, constables, and police officers to assist him or them in the discharge of the duty provided for in this act, and it is hereby made the duty of sheriffs, constables, and police officers to

assist such commissioner or inspector, when requested to do so, and he or they shall have the same powers and protection, while engaged in the discharge of his or their duties, which peace officers have.

Animals from other States. SEC. 12. When animals are transported within this State from places beyond its boundary lines, which places the board of cattle commissioners deems to be infected, such animals may be seized and quarantined by the commissioners at the expense of the owners or consignees thereof, so long as the public safety requires; and if, in their judgment, it is necessary to secure that safety, they may cause such animals to be killed without appraisal of or payment for the same.

Orders to be recorded and published. SEC. 13. All orders and regulations made by said board under the provisions of this act shall be spread upon the records of the board, and a copy thereof shall be sent to each inspector in the city or town to which the regulations or orders apply, and shall be published by such inspector in such manner as the orders and regulations shall prescribe.

Notification; penalty. SEC. 14. Whenever in any city or town the board of health or any member or agent thereof, or any other person, except the members of the board of cattle commissioners, who has knowledge of or has good reason to suspect the existence of any contagious disease among any species of domestic animals within the limits of this commonwealth, or that any domestic animal is affected with any such contagious disease, whether such knowledge is obtained by personal examination or otherwise, shall immediately give written notice thereof to the board of cattle commissioners or any of its members, agents, or inspectors, and for failure so to do shall be punished by a fine not exceeding one hundred dollars: *Provided, however,* That no such notice shall be given in the city of Boston relating to the diseases known as glanders, farcy, and rabies, which diseases shall be cared for by the board of health of the city of Boston.

To inspect upon notification. SEC. 15. Upon the receipt of such notice from any person the board of cattle commissioners shall inspect or cause to be inspected by its authorized agents any such animal or animals, and if upon such inspection such board or such inspector suspects or has reason to believe that contagion exists, the board or inspector shall proceed according to the provisions of sections twenty-three, twenty-four, twenty-five, and twenty-six of this act.

Warrant for search. SEC. 16. When complaint is made on oath to any police, district, or municipal court, or to any magistrate authorized to issue warrants in criminal cases, that the complainant believes that any diseased animal or animals are kept or concealed in any particular building, place, or inclosure, the court or magistrate, if convinced that there is reasonable cause for such belief, shall issue a warrant to search for such animal or animals, and all such warrants shall be directed and executed as provided in section three of chapter two hundred and twelve of the public statutes. If, upon a hearing said court or magistrate determines that any such diseased animal or animals were so kept or concealed, the same shall be destroyed or disposed of by the board of cattle commissioners or its authorized agent, and no compensation shall be paid to the owner or owners thereof. If the court or magistrate does not so determine said animal or animals shall be returned to the owner.

Cities to appoint inspectors. SEC. 17. The mayor and aldermen of cities, except as provided in chapter two hundred and fifty of the acts of the year eighteen hundred and ninety-six, and the selectmen of the towns shall, within thirty days after the passage of this act, and thereafter annually in the month of March, appoint one or more persons to be the inspectors of animals subject to the approval of the board of cattle commissioners. Each inspector shall be sworn faithfully to discharge the duties of his office, and shall receive a reasonable compensation, to be paid by the city or town for which he is appointed. Such city and town officers shall have the power to remove any inspector appointed by them, and in such case shall immediately appoint another in his place. Every city and town shall, within thirty days after the passage of this act, and thereafter before the first day of April in each year, send to the board of cattle commissioners a list of the qualified inspectors of animals appointed under this section for such city or town, which notice shall give the name and address of each such inspector and his occupation.

Penalty for noncompliance. SEC. 18. Whenever the officers of a city or town neglect or refuse to carry into effect the provisions of section seventeen of this act such city or town shall be liable to forfeit a sum not exceed-

ing five hundred dollars for each such refusal or neglect, and the board of cattle commissioners shall have the power to appoint one or more persons to be such inspector or inspectors for such city or town. Said board shall also have the power to remove any inspector of animals appointed under the provisions of this act whenever such inspector neglects or refuses to be sworn or, in the opinion of the board, does not properly perform the duties of his office, and in such case the board shall appoint another inspector to serve for the remainder of his term. Every

Compensation of Inspector. inspector appointed by said board shall be sworn faithfully to discharge the duties of his office and shall receive such compensation, not exceeding the sum of five hundred dollars a year each, as said board shall determine. Such compensation shall be paid by the city or town for which he is appointed.

Inspectors' records. SEC. 19. Every inspector shall keep a record of all inspections made by him and his doings thereon, and shall make regular returns of all such inspections to the board of cattle commissioners. Such records and returns shall be made in such form and at such times as the board of cattle commissioners shall direct, and said board shall have at all times the right to inspect said records and make copies thereof.

Duties of inspectors. SEC. 20. The duties of inspectors appointed under the provisions of chapter four hundred and ninety-one of the acts of the year eighteen hundred and ninety-four and of acts in amendment thereof, except as far as they relate to the duties, rules, and regulations of the board of cattle commissioners, as defined in this act, shall hereafter be performed by the various cities and towns; and said boards of health shall have full power in all matters included under the provisions of said chapter four hundred and ninety-one and of acts in amendment thereof, except that the board of cattle commissioners, in accordance with the provisions of this act, so far as not otherwise provided in section fourteen relating to glanders, farcy, and rabies in the city of Boston, shall have full control and authority in all matters relating to contagious diseases among domestic animals.

Inspectors to enforce regulations. SEC. 21. Every inspector appointed under the provisions of this act shall carry out and enforce all regulations and orders directed to him, under the provisions of this act, by the board of cattle commissioners or by any of its members.

Duties of inspectors. SEC. 22. Said inspectors shall make regular and thorough inspections of all neat cattle, sheep, and swine found within the limits of their several cities and towns, except as provided in section fourteen of this act. Such inspection shall be made at such times and in such manner as the board of cattle commissioners shall from time to time direct. They shall also make, from time to time, inspections of all other domestic animals within the limits of their several cities and towns whenever they have knowledge or reason to suspect that such animals are affected with or have been exposed to any contagious disease, and they shall immediately inspect any and all domestic animals, and any barn, stable, or other premises where any such animals are kept, whenever directed so to do by the board of cattle commissioners or any of its members: *Provided, however,* That nothing in this act shall apply to the inspection of sheep or swine slaughtered in wholesale slaughtering establishments or to the obtaining of a license for the slaughtering of such sheep or swine.

Certificate. SEC. 23. Whenever an inspector is convinced by examination of any neat cattle, sheep, or swine that such animals are free from contagious disease, he shall deliver to the owner or to the person in charge thereof a written certificate of their condition, signed by him, which certificate shall be in such form as the board of cattle commissioners shall prescribe, and shall cause a copy of said certificate to be entered upon his records.

Quarantine or Isolation. SEC. 24. Whenever any inspector, upon an examination of any domestic animal suspects or has reason to believe that such animal is affected with a contagious disease, he shall immediately cause said animal to be quarantined or isolated upon the premises of the owner or of the person in whose charge it is found, or in such other place or inclosure as he may designate, and shall take such other sanitary measures to prevent the spread of such disease as may be necessary or as shall be prescribed by any order or regulation issued by the board of cattle commissioners. Such inspector shall also deliver to the owner or person in charge of such animal, or to any person having an interest therein, a written notice or order of quarantine signed by him, which notice or order shall be in such form as the board of cattle commissioners shall prescribe, and he shall cause a copy of said notice to be entered upon his records.

Notification, how served. SEC. 25. Such notice or order may be served by an officer authorized to serve civil process, or it may be delivered by the inspector to the owner or person having an interest in the animal concerned, or to the person in charge of such animal, or may be left at the last and usual place of abode of such owner or person, or may be posted upon the premises where said animal is quarantined or isolated, and a copy of said notice or order of quarantine, with the return of said officer or inspector thereon that such service has been made, shall be competent evidence in any court that such quarantine has been imposed. Whenever any animal has been quarantined by an inspector under the provisions of this act, such animal shall remain in quarantine until the further order of the board of cattle commissioners or of any of its members.

Expense of quarantine. SEC. 26. When any animals are quarantined, collected, or isolated under the provisions of this act upon the premises of the owner or of the person in possession thereof at the time such quarantine is imposed, the expense thereof shall be paid by such owner or person in possession; but whenever specific animals are quarantined or isolated under the provisions of section six or section twenty-four of this act, more than ten days upon such premises, as suspected of being affected with a contagious disease and the owner is forbidden to sell any of the product thereof for food, or whenever any animals are quarantined, collected, or isolated on any premises other than those of such owner or person in possession thereof, the expense of such quarantine shall be paid by the commonwealth.

Notice of quarantine. SEC. 27. Whenever any inspector has caused any domestic animal to be quarantined, as provided in section twenty-four of this act, he shall immediately give a written notice thereof, together with a copy of the order of quarantine, to the board of cattle commissioners, and shall give such information to no other person.

Penalty for hindering inspection. SEC. 28. For the purpose of inspecting or examining any animal under the provisions of this act any inspector, duly qualified, may enter any building or buildings, or any part thereof, inclosure or inclosures, or other place where any such animal is kept, and may examine or inspect the same. Any person who prevents, obstructs, or interferes with any such inspector or other person having the power and authority conferred upon inspectors under this act, in the performance of any of his duties as provided herein, or who shall hinder, obstruct, or interfere with his making any such inspection or examination, or who shall secrete or remove any animal, for the purpose of preventing the same from being inspected or examined under the provisions of this act, shall be punished by fine not exceeding one hundred dollars, or by imprisonment in jail not exceeding sixty days, or by both such fine and imprisonment.

Inspectors to examine buildings, etc. SEC. 29. It shall be the duty of inspectors, in addition to their inspections of animals for contagious diseases, to examine the barns, stables, or other inclosures in which neat cattle are kept, with reference to their situation, cleanliness, light, ventilation, and water supply, and the general condition and cleanliness of the said neat cattle, and to make a detailed report, with names and residences of owners, to the board of cattle commissioners, who shall embody the same in its annual report to the Legislature.

Commonwealth to pay half of compensation. SEC. 30. One-half of the compensation of inspectors of animals appointed under the provisions of sections seventeen and eighteen of this act, in cities and towns of less than two and one-half million dollars valuation, shall hereafter be paid from the treasury of the commonwealth: *Provided, however,* That no inspector shall receive from the commonwealth more than two hundred and fifty dollars as compensation in any one year.

Duty of inspectors; penalty. SEC. 31. Every inspector of animals appointed under the provisions of this act shall carry out and enforce all lawful regulations, orders, and directions of the board of cattle commissioners or of any of its members, and any such inspector who neglects or refuses to carry out the same shall be punished by a fine not exceeding five hundred dollars for every such offense.

Penalty. SEC. 32. Every animal quarantined or isolated by order of the board of cattle commissioners or any of its members or agents, or of any inspector, in accordance with the provisions of this act, shall, during the continuance of such quarantine or isolation, be deemed to be affected with a contagious disease. Any person who shall knowingly break or authorize or cause to be broken any

quarantine imposed under the provisions of this act, or who, contrary to such order of quarantine or isolation, shall knowingly remove, authorize, or cause to be removed from any building, place, or inclosure, where the same is quarantined or isolated, any animal, or who, contrary to any order or notice of quarantine, shall knowingly place or cause or authorize to be placed any other animal or animals within a building, place, or inclosure where any animal or animals are quarantined, or in contact therewith, or who shall knowingly conceal, sell, remove, or transport, or knowingly cause or authorize to be concealed, sold, removed, or transported, any animal, knowing or having reasonable cause to believe that such animal is affected with a contagious disease, or who shall knowingly authorize or permit any such animal to go at large upon any way, street, or highway within the limits of this commonwealth, or who shall knowingly bring or authorize or permit to be brought from any other country, State, district, or territory into this commonwealth, any animal which is affected with or has been exposed to any contagious disease, or who shall disobey any lawful order or regulation of the board of cattle commissioners or any of its agents, or of any inspectors in the discharge of his or their duty under the provisions of this act, shall be punished by fine not exceeding five hundred dollars or by imprisonment not exceeding one year or by both such fine and imprisonment.

Arbitration in disagreement.

SEC. 23. If the owner, who is entitled to compensation under section eight of this act, for an animal destroyed as being affected with tuberculosis, and the commissioner condemning the same, can not agree as to the value of the animal so condemned, the value shall be determined by arbitrators, one to be selected by the commissioner and one to be selected by the owner; or if the owner neglects or refuses for twenty-four hours to select an arbitrator the one already selected shall select a second, and if these two can not agree a third shall be selected by the two arbitrators first selected. Such arbitrators shall be sworn faithfully to discharge the duties of their office, and shall determine the value of such animal according to the provisions of section eight; and the full value so determined shall be paid to the owner as provided in said section. Either party aggrieved by the doings of the cattle commissioners, or any of its members, under the provisions of said section eight, or by the award of such arbitrators, may petition the superior court for the county where such animal was killed, or for the county of Suffolk, to have the damages assessed. Such petition shall be by or against the board of cattle commissioners, and a copy thereof shall be served upon the defendant, or, if the petition is against said board of cattle commissioners, upon one of the commissioners, in the same manner as is provided for the service of other civil process. The petition shall be filed in the clerk's office of the superior court for said county within thirty days after the killing of such animal or animals. The petition shall be subject to the provisions of section sixty-nine of chapter one hundred and sixty-seven of the public statutes, and a trial may be had thereon at the bar of the court, in the same manner as other civil cases are tried. If upon such trial it shall be determined that

Compensation for condemned animals not diseased.

such animal was not affected with the disease for which it was condemned, reasonable compensation may be recovered therefor, and if the owner recovers damages in excess of the amount previously awarded to him by the arbitrators, or allowed him by the commissioners, he shall recover his costs; otherwise he shall pay costs. The damages, costs, and expenses incurred by the commissioners in prosecuting or defending any such action shall be paid by the commonwealth.

Notification of owner and board.

SEC. 34. Every person who kills or causes to be killed, with the consent of the owner or person in possession thereof, any animal under suspicion that the same is affected with or has been exposed to a contagious disease, or who, upon the inspection of the carcass thereof, finds or is of the opinion that the same is affected with a contagious disease, shall notify such owner or person in possession thereof of the existence of such disease, and shall also immediately notify the board of cattle commissioners, its agent or inspector, of the same and of the place where the animal was found, the name of the owner or owners or person or persons in possession thereof, and of the disposal made of such carcass. Any person violating the provisions of this section shall be subject to the same penalties as are provided in section twenty-eight of this act.

"Contagious diseases" defined.

SEC. 35. Contagious diseases under the provisions of this act shall include glanders, farcy, contagious pleuropneumonia, tuberculosis, Texas fever, foot-and-mouth disease, rinderpest, hog cholera, rabies, anthrax or anthracoid diseases, sheep scab, and actinomycosis.

Penalty. SEC. 36. Any person who fails to comply with a regulation made or an order given by the board of cattle commissioners or by any of its members, in the discharge of its or his duty, shall be punished by a fine not exceeding five hundred dollars or by imprisonment not exceeding one year.

Prosecutions, where held. SEC. 37. Prosecutions under this act shall be instituted and maintained in the county where the offense was committed.

Movement of cattle restricted. SEC. 38. No Texan, Mexican, Cherokee, Indian, or other cattle, which the cattle commissioners decide may spread contagious disease, shall be driven, contrary to any order of the board of cattle commissioners, on the streets of any city, town, or village, or on any road in this commonwealth, or outside the stock yards connected with any railroad in this commonwealth.

Separate pens for Western cattle. SEC. 39. In all stock yards within this commonwealth said Texan, Mexican, Cherokee, Indian, or other cattle which the commissioners decide may spread contagious disease shall be kept in different pens from those in which other cattle are kept.

Penalty. SEC. 40. Any person or persons violating the provisions of the two preceding sections shall be punished by a fine of not less than twenty nor more than one hundred dollars.

Power of courts of equity. SEC. 41. Courts of equity in term time or vacation may, by injunction or other proper order, upon application of the board of cattle commissioners, enforce or restrain violations of the provisions of this act.

Use of tuberculin restricted. SEC. 42. The use of tuberculin as a diagnostic agent for the detection of the disease known as tuberculosis in domestic animals shall be restricted to cattle brought into the commonwealth from any point without its limits and to all cattle at Brighton, Watertown, and Somerville: *Provided, however,* That tuberculin may be used as such diagnostic agent on any animal or animals in any part of the State, on the consent in writing of the owner or person in possession thereof, and upon any animals condemned as tuberculous upon physical examination by a competent veterinary surgeon.

Compensation for tuberculous cattle not allowed. SEC. 43. No person having animals tested with tuberculin shall be entitled to compensation from the treasury of the commonwealth for any animals which react to the tuberculin test, unless such testing be done by the board of cattle commissioners, or by its authorized agent acting as such at the time of the tests, and such testing shall be subject to the supervision and control of the board of cattle commissioners.

No compensation where noncompliance. SEC. 44. No compensation shall be allowed by the commonwealth to any owner or owners of condemned cattle who have failed to comply with any and all reasonable regulations in regard to cleanliness, ventilation, light, disinfection, and water supply which may have been imposed by the board of cattle commissioners. Any owner or owners of cattle who shall refuse to comply with any of such regulations shall be punished by fine not exceeding fifty dollars for each offense.

Powers of old board of commissioners. SEC. 45. The existing board of cattle commissioners shall, until the appointment of the new board authorized by this act, exercise the powers and discharge the duties conferred and imposed by this act upon the board of cattle commissioners, and thereafter the new board of cattle commissioners shall exercise said powers and discharge said duties.

SEC. 46. No expense shall be incurred and no money expended under this act in excess of the appropriations made therefor.

Repealing section. SEC. 47. Sections one to nine, both inclusive, twenty-seven, twenty-nine, thirty, thirty-four to forty-eight, both inclusive, and fifty to fifty-eight, both inclusive, of chapter four hundred and ninety-one of the year eighteen hundred and ninety-four, sections one, two, nine to twelve, both inclusive, and fourteen of chapter four hundred and ninety-six of the acts of the year eighteen hundred and ninety-five, chapter two hundred and seventy-six of the acts of the year eighteen hundred and ninety-six, chapter four hundred and ninety-nine of the acts of the year eighteen hundred and ninety-seven, chapter four hundred and fifty-one of the acts of the year eighteen hundred and ninety-eight, and all other acts and parts of acts inconsistent herewith are hereby repealed.

Approved May 25, 1899.

NEBRASKA.

AN ACT to amend section seventy-six of the Criminal Code of the State of Nebraska, and to repeal said section 76 as it now exists.

Be it enacted by the Legislature of the State of Nebraska:

Amendments. SECTION 1. That section seventy-six of the Criminal Code of the State of Nebraska be amended so as to read as follows:

Sale of diseased stock unlawful. "SEC. 76. It shall be unlawful for any person to sell, barter, or dispose of, or permit to run at large any horses, cattle, sheep, or domestic animal, knowing that such horse, cattle, sheep, or domestic animal is infected with contagious or infectious disease, or have been recently exposed thereto, unless he shall first duly inform the person to whom he may sell, barter, or dispose of such horse, cattle, sheep, or other domestic animal, of the same; and any person so offending shall be fined in any sum not less than twenty dollars nor more than one hundred dollars, or be confined in the jail of the county not exceeding three months."

Repealing clause. SEC. 2. That section seventy-six of the Criminal Code of the State of Nebraska as heretofore existing, be and the same hereby is repealed.

Approved March 30, 1899.

NEVADA.

AN ACT to amend an act entitled "An act to prevent the dissemination of contagious diseases among sheep, to provide for the appointment of sheep inspectors in the several counties of this State, and to define their duties and compensation," approved February 23, 1893.

The people of the State of Nevada, represented in Senate and Assembly, do enact as follows:

Powers and duties of inspector. SECTION 1. Section two of said act is hereby amended to read as follows:

"SEC. 2. Said inspector is hereby empowered (and it shall be his duty) to administer oaths and to personally examine all sheep and bands of sheep in his county every year, between the first day of March and the first day of July, and again between the first day of September and the first day of December of each and every year and also at any time he may be called to do so, by request in writing, of at least five persons owning or controlling any sheep, said persons making a written statement that said sheep (stating their locality and name of owner) are affected with some infectious or contagious disease, to at once proceed to examine said sheep, and if upon examination said sheep are found to be affected or infected with any infectious or contagious disease, and there is imminent or immediate danger of the spreading of said disease, and that it will cause great and irreparable injury to other owners in the vicinity of said infected or affected sheep, the said inspector shall forthwith issue his orders quarantining said sheep, and he shall engage a sufficient number of persons to hold said sheep secure from other sheep, and shall immediately dip, or cause to be dipped, all of said sheep found to be so affected. Each inspector

Appointment of deputy inspectors. may appoint one or more deputies, not exceeding one for each precinct, for whose acts he shall be responsible, and by any of whom he may perform any act required of him by this act, except the semiannual inspections, which shall be made by the inspector in person; and it shall be the duty of the inspector to advertise in at least one local paper, if there be one in his county, at his own expense, the names and postoffice address of any and all of his deputies. Any indebtedness incurred under the provisions of this act except for which the inspector should pay, may be recovered by such inspector in his official capacity by an action in any court having jurisdiction of the amount. He shall also, at the request of the owner or owners of any sheep about to be brought from any other State or Territory into this State, make an examination of such sheep, and if found free from all contagious or infectious disease, certify to such fact, as provided in section 3 of this act."

Notification to dip. SEC. 2. Section 5 of said act is hereby amended so as to read as follows:

"SEC. 5. Whenever, on examination of any bands or herds of sheep kept or herded in any county of this State, the inspector shall find such sheep or any portion of them afflicted with scab or any infectious or contagious disease, he shall forthwith

notify the person in charge of such sheep in writing to dip such sheep for said disease within a period of 30 days from such notice, and also during such period to keep such sheep from contact with other sheep by such means as he may direct; and if the owner or owners or person or persons in charge of such sheep shall not dip said sheep for said disease, as required by said notice, within said 30 days, or if said diseased sheep shall not be kept from contact with other sheep that are free from said disease by such means as the said inspector may specify, the owner or owners or person or persons controlling said sheep shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred nor more than two hundred and fifty dollars; and in case said sheep shall have not been dipped for said disease, the inspector shall immediately take possession of said sheep and dip them for said disease, and all expenses incurred in so doing, including a compensation of \$3 per day or part of a day in which the inspector may be engaged in dipping said sheep, shall become a lien upon said sheep, and the inspector shall hold the sheep until the same is paid; or, if it be not paid within 10 days after such dipping is completed, he shall collect the same together with the costs and expenses of collection, by advertising and selling said sheep or so many thereof as may be necessary, in the manner provided by law for the sale of personal property upon execution. If, however, at the expiration of 30 days from such notice as before mentioned the inspector finds that said sheep have been dipped for such disease but are still infected with the same disease, then he shall instruct the owner or controller of said sheep to dip said sheep a second time as soon as possible, but with an interval between the dippings of not less than 15 nor more than 30 days, and if upon examination at the end of 30 days further the inspector finds that said sheep have been dipped but are still infected, then he shall at once take possession of said sheep and dip them for said disease, as above specified. If, however, upon examination, he finds that said sheep have not been dipped for said disease, he shall seize said sheep and dip them for said disease, as above specified, and the owner or owners shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred nor more than two hundred and fifty dollars; *provided*, no person, company, or corporation shall be required to dip a band of ewes in which there are ewes with lambs at any time between the first day of March and the first day of July of any year."

Approved March 6, 1899.

AN ACT providing for the appointment of a State live stock inspector, defining his duties, and fixing his compensation.

The people of the State of Nevada, represented in Senate and Assembly, do enact as follows:

Appointment of Inspector. SECTION 1. The Governor of the State of Nevada is hereby authorized and empowered to appoint a State live stock inspector to aid and assist in developing and protecting the live stock industry of the State of Nevada. Said State live stock inspector shall be of recognized skill and ability and shall hold his position at the will and pleasure of the Governor as hereto provided.

Duty of Inspector. SEC. 2. Said State live stock inspector shall devote his time to the investigation of the nature, causes of and remedies for diseases of horses, mules, cattle, swine, sheep, and other domestic animals.

Under board of health. SEC. 3. Said State live stock inspector shall be under the control of the board of health, who may request the removal of said inspector whenever in their judgment the good of the State may demand it.

Inspector demanded, when. SEC. 4. It shall be lawful for any five freeholders and residents of this State to go before a justice of the peace, the district attorney, or the board of county commissioners and demand the presence and services of the said State live stock inspector.

Duty of officers and Inspector. SEC. 5. It shall be the duty of the justice of the peace, district attorney, or board of county commissioners to notify said State live stock inspector at once at his office by letter or telegram. It shall be his duty to go to the locality named and give such aid and instructions as he may think best for the prevention or cure of the diseases with which he shall find such live stock infected with.

Diseased animals. SEC. 6. If upon investigation said State live stock inspector shall be satisfied that said live stock is infected with what is known as pleuropneumonia, tuberculosis, anthrax, glanders, or any other contagious and

infectious disease against which he may think best to quarantine, he shall immediately notify the district court of the judicial district or one of the judges thereof in vacation in said county in which said diseased stock may be found, setting forth in writing the number of stock infected, the character and type of the disease. Said court or judge thereof in vacation shall thereupon issue an order in writing commanding the sheriff to immediately summon five freeholders being stock raisers who shall proceed at once to the locality where such diseased stock may be, and carefully examine the same with the inspector. If a majority of the freeholders shall find such stock infected as aforesaid, they shall certify such finding in writing to the court or judge aforesaid, who shall thereupon issue an order in writing commanding the sheriff to compel the owners or other persons in whose possession such diseased stock shall be found to immediately quarantine such diseased stock and to close all creameries or dairies in the affected district until such time as the disease abates, and that no stock shall be moved from the infected district until they have been examined and the inspector's certificate of health accompanying them, and that all stock dying from contagious or infectious diseases that their carcasses shall be burned immediately and not buried or left to decay. [And that the carcasses of all stock dying from contagious or infectious diseases shall be burned immediately and not buried or left to decay.]

Inspection of Import animals;
inspector's fee.

SEC. 7. No stock from affected districts in other States or Territories will be allowed to cross the line and enter Nevada until they have first been inspected at the owner's expense. The inspector's fee shall be \$10 per day and necessary traveling expenses. This shall be applied to the general fund of the State of Nevada. The inspector may be notified by letter or telegram; he shall go at once to the place on the border line mentioned and inspect said stock; if found healthy, [he shall] give a certificate of health to those in charge of said stock on the payment of inspector's fees and necessary traveling expenses.

SEC. 8. Any person or persons, company, or corporation who shall violate any provision of this act shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in any sum not to exceed \$500 nor less than \$50 or by imprisonment in the county jail not more than 6 months nor less than 60 days for each offense.

Compensation.

SEC. 9. The sheriff shall receive for his services under this act such compensation as is now provided by law for similar labor and the freeholders making such examinations as aforesaid shall receive such compensation as is now provided by law for jurors' services, which shall be allowed by the district court of the district and paid out of the county treasury in which such diseased stock shall be found, as other claims are paid.

Monthly reports; contents.

SEC. 10. Said inspector shall report to the board of health in writing at least once in every month setting forth the locality or localities visited as provided in the preceding sections, the kind of stock inspected, the time taken to inspect them, the number admitted to cross the line into Nevada, the number permitted to leave infected districts and to whom certificates of health for stock were given and the amount of fee received for inspecting and issuing certificates, also the kind of stock treated, the type and character of the disease, the remedies prescribed, and the results as far as known. He shall also render an account for the number of miles traveled and the actual sum of money paid out by him therefor, and if found correct shall be audited and allowed by the board as is now provided by law.

Publication of report.

SEC. 11. The secretary of the aforesaid board shall from time to time select from said report and publish such information as he may think valuable to the people of Nevada. This information may be published in connection with the report relating to agriculture or in a separate bulletin.

Salary of inspector.

SEC. 12. The State live stock inspector herein provided for shall receive a salary not to exceed \$1,200 per annum and necessary traveling expenses, payable out of the general fund of the State of Nevada as other claims are paid.

Approval by board of examiners.

SEC. 13. The State controller is hereby authorized, empowered, and required to draw his warrant in favor of the State live stock inspector created by this act for the salary and traveling expenses provided for in this act, when approved by the board of examiners, and the State treasurer is hereby authorized, empowered, and directed to pay the same.

Report to Legislature. SEC. 14. It shall be the duty of the secretary of said board of health to collect the information derived from the report made by said inspector, as provided for in this act, and make a report to the State Legislature within 10 days of the date of the meeting thereof, [embodying] such data and useful knowledge, together with suggestions as may be beneficial to the stock interests of the State of Nevada.

Act in force. SEC. 15. The fact that there now exist in certain parts of this State germs of anthrax and dangerous infectious diseases among domestic animals creates an emergency within the meaning of the constitution, therefore this act shall be in force from and after its passage.

Domestic sheep exempt SEC. 16. Domestic sheep are exempt from the provisions of this act. Sheep entering this State from adjoining States or Territories are also exempt after they have been in this State 6 months.

Became a law March 23, 1899.

DELAWARE.

AN ACT to amend chapter 639, volume 19, laws of Delaware.

Be it enacted by the Senate and House of Representatives of the State of Delaware in General Assembly met:

SECTION 1. That the following be added to chapter 639, volume 19, laws of Delaware, as section 10 of said chapter, to wit:

Vaccination for anthrax. "That, whenever the Governor shall receive reliable information that the contagious disease known as anthrax exists he is hereby authorized, at his discretion, upon the request of the owner of such domestic animals as are exposed to said contagious disease, to order the same vaccinated by skilled persons with Pasteur vaccines; *provided*, the owner of said domestic animals assumes the risk of whatever losses may result therefrom."

Expenses. The Governor is hereby authorized to draw his warrant upon the fund appropriated by section 9 of this act hereby amended for the purpose of defraying the expenses incurred in vaccinating as aforesaid.

Passed May 10, 1897.

AN ACT to amend chapter 630, volume 17, laws of Delaware.

Be it enacted by the Senate and House of Representatives of the State of Delaware in General Assembly met:

Cremating animals dead of anthrax. SECTION 1. That section 2 of chapter 630, volume 17, laws of Delaware, be and the same is hereby amended by adding to said section the following, to wit:

"If any person being the owner of any domestic animal which has died from anthrax and who shall immediately after the death of such animal cremate the carcass of the same shall within 10 days make the death of said animal known to the Governor, he shall be paid by the State treasurer, upon the warrant of the Governor, for each animal that has so died the sum hereinafter mentioned, to wit: In the case of horned cattle, horses, and mules, the sum of \$8; in the case of swine, the sum of \$2; in the case of sheep, the sum of \$1; *provided*, that the owner of said dead animal shall first secure a certificate of death of such animal by anthrax from the Delaware College Agricultural Experimental Station or in such manner as the Governor may direct."

Passed May 10, 1897.

NEW JERSEY.

A FURTHER SUPPLEMENT to an act entitled "An act concerning contagious and infectious diseases among animals, and to repeal certain acts relating thereto," approved May fourth, one thousand eight hundred and eighty-six.

Be it enacted by the Senate and General Assembly of the State of New Jersey:

Amendment. SECTION 1. The second section of the act entitled "A supplement to an act entitled 'An act concerning contagious and infectious diseases among animals, and to repeal certain acts relating thereto,'" approved May fourth, one thousand eight hundred and eighty-six, which supplement was approved May

twenty-second, one thousand eight hundred and ninety-four, and which further supplement was approved March twenty-eighth, one thousand eight hundred and ninety-five, be and the same is hereby amended to read as follows:

Inspection and valuation. SEC. 2. Whenever the State tuberculosis commission shall be notified by the secretary of the state board of health or the State dairy commissioner or any owner or owners of dairy animals requesting them to inspect animals supposed to be diseased with tuberculosis, such person or persons may be designated by the commission shall proceed to make such inspection and may agree with the owner or owners upon a valuation of such animals as are to be inspected; in cases where no agreement can be reached the person designated by the commission shall choose one disinterested freeholder, the owner or owners shall choose one, and the two shall designate a third, who shall ascertain and decide upon the market value of each animal to be examined by the commission, and shall sign certificates thereof in the presence of a witness who shall attest the same; such valuation shall in each case be made on the basis of the market value of the animals the day the valuation is made; and if, upon examination by the commission, any animals in said herd are condemned to be slaughtered, three-fourths of such valuation so ascertained shall be paid by the state to the owner or owners on presentation of such certificate with the approval of the said commission endorsed thereon; *provided*, such appraisement shall not exceed forty dollars for each animal condemned; and *provided further*, that no compensation shall be made for animals considered by the commission to be of no value.

Appropriation. SEC. 3. Section five of said act be amended to read as follows: "SEC. 5. There shall be appropriated to the State tuberculosis commission the sum of ten thousand dollars for defraying the expenses and for the payment of the proportion of the appraised value of slaughtered animals under this act, all which payments and expenses shall be made by the treasurer of this state upon the warrant of the State comptroller; *provided*, that no payments shall be made pursuant to this act until the amount thereof shall have been included in the annual appropriation bill."

SEC. 4. This act shall take effect immediately.
Approved April 6, 1898.

NEW MEXICO.

AN ACT in relation to the shipment of cattle, to provide for the inspection of the same, and to repeal sections 211 and 221 of the compiled laws of New Mexico of 1897, C. S. H. S. C. H. A.

Be it enacted by the Legislative Assembly of the Territory of New Mexico:

Unlawful transportation. SECTION 1. That hereafter it shall be unlawful for any person, firm, or corporation to offer, and for any railroad company or other common carrier to receive, for purpose of shipment or transportation from points within to other points within or beyond the limits of the Territory, any herd, band, or consignment of cattle unless the same shall have been duly inspected by a duly authorized inspector and a certificate of such inspection issued by such inspector as required by the laws of this Territory.

Fees and records. SEC. 2. That there shall be a fee or charge for the inspection of cattle hereafter inspected under the provisions of this act of three cents per head, and such fee or charge shall be a lien upon the cattle inspected under the provisions of this act until the same shall be paid; each inspector of cattle shall keep a complete record in a proper book of all cattle inspected by him, giving all brands and marks and the name or names of the shipper or shippers of the same, and a copy of said record shall be filed with and preserved by the Cattle Sanitary Board of the Territory.

Penalty. SEC. 3. That any person, firm, corporation, common carrier, railroad company, or agent thereof violating any of the provisions of this act or refusing to permit the inspection of any cattle as by this act provided, shall upon conviction thereof be deemed guilty of a misdemeanor and shall be fined in any sum not exceeding one thousand dollars for each violation of the provisions of this act.

Repeal. SEC. 4. That Sections 211 and 221 of the Compiled Laws of New Mexico of 1897, be, and the same are hereby repealed; and this Act shall take effect and be in force from and after its passage.

Approved March 16, 1899.

AN ACT to repeal sections 161, 162, 163, 164, 165 and 166 of the compiled laws of 1897; to prevent the introduction and spread of diseases among sheep and other animals, and to further protect the sheep industry in the Territory of New Mexico.

Be it enacted by the Legislative Assembly of the Territory of New Mexico:

Organization and location of office. SECTION 1. That the Sheep Sanitary Board shall organize within thirty days after the appointment of its members has been confirmed by the legislative council, by electing, from their number, a president and a vice president, and by appointing a secretary who need not, however, be a member of the board. As soon as possible after their organization, the board shall select and designate some place in the Territory as its principal office and place of business, and the place so selected and designated shall not be changed during the year in which it was so selected, but may be changed thereafter from year to year, by the selection of some other place at the discretion of the board.

Time of meeting. SEC. 2. The board shall hold at its principal office two regular meetings in each year, beginning on the second Thursday in the months of June and December, special meetings may be held upon the call of the president, or in case he should be absent from the Territory, of the vice-president, at such other times and at such places as in his judgment the business of the board may require.

Salaries and expenses. SEC. 3. The members of the board shall not receive any compensation for their services, but their actual, necessary expenses in attending the meetings of the board, shall be paid upon their rendering itemized bills therefor, after the same have been audited and allowed by the board.

SEC. 4. The board is hereby authorized and empowered—

Power of removal. First. To appoint, and at its pleasure to remove, sheep inspectors who, under the control of the board, shall discharge the duties imposed on them by this act and such rules and regulations as may be prescribed by the board, and shall receive such compensation as may be fixed by the board.

Issue regulations. Second. To adopt and publish such rules and regulations as it may deem proper for the transaction of its business and for the government of the inspectors, not inconsistent with this act.

Prescribe methods for dipping sheep. Third. To prescribe such methods to be observed in the dipping of sheep as to them may seem proper, and best adapted to prevent disease and the spread thereof among sheep, and in accordance with the provisions of this act.

Regulations governing quarantines. Fourth. To prescribe and publish such rules as it may consider to be best adapted to carry into effect the quarantine and sanitary provisions contained in this act, and to dictate and prescribe such other quarantine and sanitary measures, as circumstances may require for the prevention of disease or the spread thereof among sheep; and summarily to order the quarantining of any infected flock or flocks of sheep, whenever circumstances may require it; and in matters of sanitation and quarantine, for the protection of sheep in this Territory its decision shall be final. The enumeration of the special powers hereby conferred on the

Other powers not prohibited. board, shall not be construed to operate as a denial to it of such others as should properly be exercised by such a board; and in all matters relating and appertaining to the preservation of a healthy condition among sheep, the prevention of illegal or improper handling or dealing in sheep, registration of owners, marks, and brands, and the keeping of records of all sheep entered or leaving the Territory, and in all matters of sanitation and quarantine, the said board is hereby given full powers to enforce both the provisions contained in this act, and the rules and regulations prescribed by the said board, in accordance with this act.

Rules for importation of sheep. SEC. 5. Any person intending to bring any sheep into the Territory of New Mexico from any other country, State, or territory, shall give notice in writing of his intention so, to do to the secretary of the board by telegraph, by registered letter, or by delivery in person so that the notice shall be received at least forty-eight hours previous to the proposed day of entry, stating in said notice the day and place, when and where, he desires to bring said sheep in. Upon receiving said notice the secretary shall, immediately notify an inspector who shall at once go to the place named, and inspect said sheep, and if the same are found to be clean and healthy, and free of any contagious or infectious disease he shall deliver to the owner, or to the person in charge of them a certificate of health for the flock, which shall authorize said sheep to be brought into the Territory, and the owner, or person in charge of

said sheep shall pay to the inspector a fee of five cents per head for such inspection; *Provided, however,* that the provisions of this section shall not apply to sheep loaded on railroad cars which are being transported from some country, state, or territory to another country, state, or territory through the territory of New Mexico, and which are not to be unloaded and landed in this Territory, except in quarantine pens for the purpose of feeding and watering the same, and for a period of time not to exceed twenty-four hours.

When dipping is required.

SEC. 6. If at the inspection spoken of in the preceding section the inspector should find that the sheep are infected with scab, or other contagious or infectious disease, he shall require the owner or the person in charge of them to dip them in the manner that may be prescribed by the rules and regulations of the board, before bringing said sheep into the Territory, if that can be conveniently done, but if it can not be done conveniently, then he shall allow them to be brought into the Territory, but only for the purpose of causing them to be properly dipped under his own supervision, at the nearest obtainable dipping vats; and in the meantime, and until said sheep are free from disease, he must see that the quarantine regulations prescribed by the board in such cases are strictly observed, and as well as any other orders or rules of the board. When the inspector shall pronounce the said sheep clean and healthy, he shall issue to the owner, or person in charge of them, a certificate of health as provided in the preceding section, upon the payment to him of the inspection fee named in the said preceding section.

Collection of fees.

SEC. 7. Should the owner or person in charge of any sheep that are about to be brought into this Territory from another country, State, or territory, fail or refuse to pay the inspection fee provided for in section five of this act, the inspector making the inspection of said sheep shall refuse to deliver the certificate of health mentioned in said Section 5, and shall not permit said sheep to enter the Territory; but if they are brought into the Territory notwithstanding his said refusal, or if said sheep be already in the Territory at the time of such inspection, he shall immediately take charge of the flock, and shall not allow them to be driven away; he shall, at once, notify the secretary of the board, or the nearest or most accessible member of said board, of that fact, and upon being authorized thereto by the board he shall immediately go before the district judge, or some justice of the peace in the county where the said sheep may then be found, and make complaint against the said owner, or the person in charge of said sheep, in the manner provided in section 19 of this act, and proceed as indicated therein, to enforce the payment of said inspection fee, and of the costs that he may have necessarily incurred in keeping said sheep, from the time that he took charge of them, together with the costs of the legal proceedings.

Inspection of sheep required.

SEC. 8. When any inspector learns that any flock or flocks of sheep have been brought into this Territory from some other country, State, or territory, without having been first inspected, as provided for in Section 5 of this act, he shall immediately inspect said sheep, as in said section five as provided.

Penalty.

SEC. 9. That any person or persons who shall hereafter bring any sheep into the Territory of New Mexico, from any other country, or State or territory, without complying with the provisions contained in section 5 of this act, shall upon conviction thereof before any justice of the peace or district court in this Territory, be fined in any sum not less than fifty dollars nor more than one hundred dollars, and in addition thereto may, in the discretion of the court trying the case, be imprisoned at hard labor in the county jail of the county for any period of time not to exceed thirty days; and a failure on the part of the owner, or person in charge of said sheep, to produce the certificate of health provided for in said section 5, shall be prima facie evidence that said sheep were clandestinely brought into the Territory, without complying with the provisions of said section. The judgment shall operate as a lien upon the sheep so clandestinely brought by such person into the territory, and said sheep, or so much thereof as may be necessary, may be sold in the same manner as is now provided by law for the sale of personal property under execution, and the proceeds applied to the payment of such fine and the costs; and it is hereby made the express duty of sheep inspectors to make criminal complaint against any person or persons who bring sheep into this Territory in violation of the provisions contained in said section 5 of this act.

Disposition of fines.

SEC. 10. That all moneys arising from fines and penalties for violation of any of the provisions of this act shall constitute part of the available sheep sanitary fund, and be paid over by the officers collecting the same to the secretary of the board.

Record of marks. SEC. 11. Every sheep owner owning or having sheep in this Territory shall record in the office of the secretary of the board the marks and brands which he may use in marking sheep, and the said secretary shall enter and record said marks and brands in a book to be kept by him for that purpose; *Provided*, that he shall refuse to record in the name of any person or persons, firm, or corporation any mark or brands which may have been previously recorded in the name of any other person or persons, firm or corporation; and *Provided, further*, that it shall be unlawful for any person, firm, or corporation to have more than one ear mark or set of ear marks in such manner as to mark different sheep in his flock or flocks with different ear marks; and the secretary shall refuse to record more than one ear mark or set of ear marks in the name of any person, firm, or corporation. And it shall be unlawful for any person, firm, or corporation to cut off more than one half of either or both ears, or to cut off both sides of either or both ears more than one half of the ear to a point, as earmarks; and no such earmarks shall be recorded by the secretary. A certified copy of any mark or brand thus recorded shall be admitted in the courts of this Territory as prima facie evidence of ownership, but, unless it be so recorded, no mark or brand shall be admitted as evidence of ownership in any of the courts in this Territory. For each recording of the marks and brands of each person, and furnishing a certificate thereof, the secretary shall be paid a fee of one dollar, which shall be paid by him into the sheep sanitary fund.

Stolen sheep. SEC. 12. Any person who shall bring into this Territory any sheep that have been stolen in any other country, State, or territory, knowing at the time of bringing them that the same were stolen, upon conviction thereof, shall be punished in the same manner as is now provided by law for the punishment for the crime of larceny of sheep; and the fact of any person being found in possession of sheep having more than one-half of either or both ears cut off, or more than one-half of either or both ears cut on both sides to a point, shall be considered prima facie evidence against him that such sheep are stolen; and it is hereby made the duty of sheep inspectors to make complaint against any person or persons found in possession of sheep thus marked; and the said sheep inspectors shall refuse admission into this Territory of any sheep bearing such marks, except upon express permission so to do by the Sheep Sanitary Board.

Inspection of export sheep. SEC. 13. It is hereby made the duty of the sheep inspectors carefully to inspect all sheep about to be shipped or driven out of the Territory, and no sheep bearing any of the earmarks declared in this act to be unlawful shall be allowed by them to be shipped or driven out of the Territory, unless expressly authorized so to do by the board. The inspector shall require each person so shipping or driving sheep out of the Territory to exhibit to him a bill or bills of sale, or authority in writing to ship or drive such sheep, executed as now provided by law for live stock, from the recorded owners of all marks and brands on such sheep, unless such person is himself such recorded owner of such marks and brands. The inspector shall also examine said sheep as to their sanitary condition: and if fully satisfied that the person proposing to ship or drive them out of the Territory has a right so to do, and that they are free from contagious or infectious disease, he shall upon payment to him of an inspection fee of five mills for each sheep inspected give to said person a bill of clearance setting out those facts, including the fact of such payment having been made, and describing the sheep, which bill shall authorize the taking of said sheep out of the Territory. It shall not be lawful for any person, firm, or corporation to offer for transportation, nor shall any railroad company in this Territory accept or receive for transportation on its lines of railroad, from this Territory to any point or place beyond its boundaries, any sheep for the transportation of which a bill of clearance as herein provided for is not first obtained by the shipper immediately before and at the place of the shipment; and any railroad company violating the provisions of this act shall be held liable in an action of debt, in the sum of five cents per head for each and every head of sheep received by it for transportation and actually transported by it, from this Territory to any point or place beyond its boundaries, without said bill of clearance, which said sum shall be recoverable for the use of the sheep sanitary fund, upon the suit of the Sheep Sanitary Board, in any court of competent jurisdiction. The said inspector shall make report to the secretary of the board, by every inspection made by him under the provision of this section, which said report shall show the name of the shipper, the place of shipping, the place of destination, the number of sheep shipped, their marks, brands and sanitary condition and the date of shipping, together with the name or names of any former owner or owners

exhibited by the shipper, and any additional matter which may be required by the board.

Report of strays. SEC. 14. Any person finding any stray sheep shall immediately report them to some sheep inspector of the county where the same were found, and shall deliver them to any inspector upon his demand therefor; and any inspector upon coming in possession of any stray sheep shall, forthwith, notify the secretary of the Sheep Sanitary Board, stating the number of sheep in his possession, their earmarks, their quality, the locality and the county where they were found and the name of the person who found them. The secretary of the board shall immediately cause a notice to be published in both English and Spanish, for four consecutive weeks, in some newspaper published in the county where said sheep were found, but if there be no newspaper published in the county, where the said secretary's office is located; which said notice shall set out a description of said sheep, their number and the name of the inspector who has charge of them, and shall direct the owner thereof to appear before the secretary of the board at his office to claim them on or before a day therein named, which shall not be later than three days after the date of the last publication; and notice shall contain a statement that unless the owner shall appear on or before the day named and prove his ownership, the said sheep will be sold at public auction, at the door of the county court house of the county where the same are being kept, to the highest bidder, for cash, on the eighth day after the last day of said publication. In addition to the said notice, if the earmarks and brands of said sheep are recorded in his office, the secretary shall notify the owner or owners of record, by registered letter, of the finding of said sheep, and shall give such further or other notice as the board may direct. On the day named for the owner to appear, the secretary shall order said sheep to be delivered to the owner of record of the earmarks and brands on said sheep, or to any person presenting a good and valid bill of sale for the same from such owner or to any other person proving ownership thereof if the marks and brands are not recorded, upon the payment of all costs incurred in the keeping of said sheep, in the publication aforesaid, and such other expenses as may have been necessarily incurred. If a person proves ownership of said sheep, the secretary shall order the inspector in charge to sell the same as in said notice provided. The moneys arising from such sale shall be paid to the board and there shall be paid therefrom the costs and expenses incurred in keeping and advertising said sheep, and in the sale thereof, and the residue if any shall be placed in the sheep sanitary fund; *Provided, however,* that if, at any time within one year after such sale, the owner of sheep so sold shall appear and prove his ownership, such residue shall be paid to him from any funds under the control of the board.

Strays must be reported. SEC. 15. Any person who shall find any stray sheep and shall fail to report the same to some sheep inspector as is provided for in the preceding section, and who shall take or in any manner dispose of them upon conviction thereof shall be deemed guilty of larceny of sheep and shall be punished accordingly.

Dipping and inspection. SEC. 16. All sheep in the Territory must be dipped at least once in each year, in accordance with the rules and regulations to be established by the board, and shall be inspected at least once in each year by the inspectors, who shall immediately after each inspection of any flock of sheep, make a report thereof to the secretary of the board, stating the number of sheep inspected, the owner of the same, their condition of health or the existence of any infectious or contagious disease or parasites among them, and such other matters and information as may be required by the board, which report the secretary of the board shall record in a proper book for reference. No sheep afflicted with scab, or other contagious or infectious disease or parasites, shall be allowed to travel except between the places where they are being herded and the dipping vats, and then only under regulations prescribed by the board; and any flocks of sheep which shall have scab shall be dipped as often as may be necessary, and until they be pronounced clean by the inspector; but no sheep shall be required to be dipped at such season of the year or during such inclement weather as would endanger their health or lives, or when the flock is in the midst of lambing.

Bill of sale. SEC. 17. No person or persons, whether as principal or agent, shall hereafter sell, nor shall any person, whether as principal or agent, hereafter buy, any sheep, unless the person or persons so selling the same, shall give to the purchaser, and the purchaser shall receive from the person selling the same a bill of sale, which shall fully describe the sheep by their marks, brands and quality and shall be duly acknowledged before some officer authorized by law to take acknowledgments; and the possession, by any person or persons, of any

sheep having any mark or brand but his own, shall, unless he have such bill of sale therefor, be taken as prima facie evidence that he has committed larceny of said sheep, and shall be sufficient for a conviction unless the evidence shall show his innocence.

Penishment. SEC. 18. Any person who may sell, or offer for sale or trade, any sheep upon which such person has not his recorded mark or brand, or for which he has neither bill of sale nor power of attorney from the owner of such sheep, authorizing such sale, shall be deemed guilty of larceny, unless such person upon trial shall establish and prove that he was, at the time, the actual owner of the sheep or that he acted by the direction of one shown or proven to be the actual owner of such sheep, and in prosecutions for a violation of the provisions of this section, it shall not be necessary, in order to warrant a conviction, for the Territory to prove motive, intent, or purpose on the part of the accused, or that the accused knew that the sheep were sold or traded or offered for sale or trade, in violation hereof, but such selling or trading or offered for sale or trade, contrary to the provisions hereof, when proved, shall be sufficient to authorize conviction, unless the accused shall, by testimony, explain the case made by the Territory in a manner consistent with good faith and innocent purpose.

Penalty. SEC. 19. Whenever, under the provisions of this act or of the rules and regulations of the sheep sanitary board in accordance with the provisions of this act, any flock or flocks of sheep must be quarantined or dipped, upon the failure or refusal of the owner or of the person in charge of such flock or flocks of sheep to comply therewith, the sheep inspector, shall, summarily, take charge of the said flock or flocks of sheep, as under attachment, and shall see that the requirements of the law and of the rules and regulations of the board, in relation to said flock or flocks of sheep, are complied with under his own directions and supervision. The costs and expenses necessary thereby incurred shall constitute a lien upon said flock or flocks of sheep, and said sheep shall remain in the custody of the inspector until said costs and expenses are fully paid, and if the owner or the person in charge of such sheep shall fail to pay said costs and expenses within eight days after the inspector has demanded the payment thereof, the sheep sanitary board shall institute legal proceedings for the recovery thereof, and said proceedings shall be as for the foreclosure of an attachment lien on said sheep, and in said proceedings no bond shall be required from said board.

SEC. 20. The inspection fees due for any inspection of any flock of sheep, shall constitute a lien upon said sheep, and said sheep, when in the custody of any sheep inspector, shall not be delivered to the owner or to the person in charge thereof, until such inspection fees have been paid; and upon the failure or refusal of said owner or person in charge to pay the same, the sheep sanitary board, shall cause legal proceedings to be instituted in its name for the collection thereof in any court of competent jurisdiction, and said sheep shall remain in the custody of the sheep inspector until the determination of said suit, and no bond shall be required from the board.

Law amended. SEC. 21. That section 168 of the compiled laws of New Mexico of 1897, be and the same is hereby amended so that hereafter it shall read as follows, to-wit:

Sheep sanitary fund. It shall be the duty of the county commissioners of each county in the Territory, at the time of levying other taxes, to levy a special tax of two mills per head on each sheep within their respective counties, to be known as the sheep sanitary fund; such special tax shall be collected in the several counties and paid to the territorial treasurer in the manner provided by law for the collection and payment of other territorial taxes. Such fund shall be kept separately by such treasurer and shall be used exclusively for the payment of any expenses properly incurred by the sheep sanitary board, and such fund shall be paid out by the territorial treasurer on the order of said board only. Such special tax shall be assessed, levied and collected at the expense of the several counties, and in case the county commissioners of any county shall fail or neglect to make the levy provided herein, they shall, each, become personally responsible to said fund in any amount equal to twenty-five per cent of said levy, to be collected from them and their bondsmen for the exclusive benefit of said fund.

Secretary to give bond. SEC. 22. The secretary of the sheep sanitary board shall, before he enters the duties of his office, qualify by giving a bond to the territory of New Mexico with good and sufficient sureties, to be approved by the president of the board, in the sum of not less than one thousand dollars, conditioned for the faithful performance of his duties under the laws and the rules and regulations of the board, which bond may be sued upon in the

name of the Territory, for the benefit of any person interested. The secretary shall keep the minutes of the proceedings of the board at regular and special meetings, and also all record books, reports, and other papers and documents belonging to the board; he shall file and securely keep all reports made to him by the different sheep inspectors; he shall keep a record showing the number of sheep in the different counties of the territory as reported to him by the different sheep inspectors, the names of the different sheep owners and the number of sheep owned by each; from the reports of the sheep inspectors he shall also keep a record of the number of sheep shipped out of the Territory and of the number imported into the Territory each year. He shall keep a record of marks and brands wherein he shall record and enter all marks filed with him for record, which said book shall show the date of record of each mark, the name of the owner and his post-office address, and, generally, he shall perform such other duties and functions as may be required of him under the rules, regulations and instructions of the sheep sanitary board. The secretary shall be paid such salary or compensation for his services as may be agreed upon between him and the board.

Payments to be authorized. SEC. 23. No moneys shall be paid out of the sheep sanitary fund unless such payment and disbursement has been authorized by a majority of the members of the Sheep Sanitary Board.

Inspectors to be practical sheep men. SEC. 24. The sheep inspectors provided for in this act must be practical sheep men, and before they enter upon the duties of their office each shall give a bond to the Territory of New Mexico, in the sum of five hundred dollars, conditioned for the faithful performance of the duties of his office, with at least two sufficient sureties, to be approved by the president of the board, which bond may be sued upon in the name of any person interested. It shall be the especial duty of said sheep inspectors to enforce all the provisions contained in this act, and in the rules and regulations of the sheep sanitary board, and for the purpose of more effectually enforcing them the said inspectors are hereby given the same powers as deputy sheriffs, and they may make arrests without warrants of any persons violating the provisions of this act, or any of them, or any of the rules or regulations of the sheep sanitary board; they shall make complaints against any such violators, and in civil cases, and criminal prosecutions that may arise under the provisions of this act, or under the rules and regulations of the board, the said inspectors may serve all papers, and mesne and final process therein, in the same manner as the sheriff of the county may or can do and he shall be entitled to the same fees that the said sheriff would be for the performance of similar services.

Quarantine. SEC. 25. Upon the receipt of information that any sheep in his county are affected with scab or if in his judgment they have been exposed to it, the inspector shall examine the same, and if he find they are infected he shall immediately quarantine, under such rules and regulations as may be prescribed by the board, and he shall keep them under quarantine until the said sheep shall be clean and healthy.

Report to the governor. SEC. 26. On or before the third Thursday of December of each year the sheep sanitary board shall make report to the governor of the Territory which shall contain a statement of all receipts and expenditures, the number of sheep in the territory as appears from the reports of the inspectors, the number of sheep exported from and imported into, the Territory during the year, and the general condition of health among sheep.

Disposition of moneys. SEC. 27. All moneys collected by any inspector shall be paid over by him to the board in such manner and within such time after collection as the board shall direct, and every inspector shall make report in writing to the board of all his acts in such form as the board may require.

Meaning of term "sheep." SEC. 28. Wherever the word sheep is used in this act it shall be construed to mean and include wethers, ewes, lambs, rams, and goats.

Penalty. SEC. 29. Any person violating the provisions of section thirteen of this act, whether by shipping or driving sheep out of the Territory without having first obtained the bill of clearance therein provided for, or by failing to pay the fees required by said section, shall be deemed guilty of a misdemeanor and shall be punished by fine of not less than one hundred nor more than five hundred dollars, and, in the discretion of the court, also by imprisonment not exceeding six months.

Members to be practical sheep men. SEC. 30. The members of the board shall be practical sheep men, owners of sheep and actually engaged in the business of sheep growing. They shall be appointed by the governor by and with the advice and consent of the legislative council and shall hold their offices for two years from date of their appointment, or until the next regular meeting of legislative council and until their successors are appointed and qualified.

Repeal. SEC. 31. That sections 161, 162, 163, 164, 165, and 166 of the compiled laws of New Mexico of 1897, being sections 2, 3, 4, 5, 6 and 7 of chapter 53 of the laws of 1897, be and the same are hereby repealed, and all laws and parts of laws in conflict with this act, be and the same are hereby repealed, and this act shall be in force from and after its passage.

Approved March 10, 1899.

NORTH DAKOTA.

AN ACT requiring the burial of animals that die from disease.

Be it enacted by the Legislative Assembly of the State of North Dakota:

Barial of animals. SECTION 1. It shall be the duty of the owner of any cattle or other domestic animals, or any person in the actual charge thereof of such animals, within this State, that die from or on account of any contagious disease (and the death of any such animal from disease shall be presumed to be contagious until the contrary is proven, also any such animal found dead shall be presumed to have died of such disease unless other causes of death are apparent), to cause the same within twenty-four hours after receiving the knowledge of the death of such animal to be buried at least four feet below the surface of the ground and covered with dirt to that depth.

Duty of overseers and coroner. SEC. 2. It is also hereby made the duty of all road and street overseers, under whatever name called, and of the county coroner in such districts where there are no road overseers to bury or cause to be buried all animals dying as in section one of this act when the same have been dead for thirty-six hours and are still unburied by the owner or person in charge thereof. The said road or street overseers and the said coroner are authorized to enter upon or into any premises where such dead cattle may be for the purpose of removing the same for burial and may bury the same on such premises, but must not bury said animals within one thousand feet of any dwelling house or barn. The board of county commissioners of such county shall allow such sums for such services as they may deem reasonable and the same shall be paid as other services for said county are paid. It is further provided that the owner of such animal or animals shall be liable to the county for such expenses, to be recovered in a civil action in the same manner as other debts are collected unless the owner pays said burial expenses within thirty days after being notified by the county auditor of the same, and no property except absolute exemptions shall be exempt from sale for the payment of any judgment that may be recovered against said owner, including costs and such attorney's fee as may be allowed by the court, not exceeding the sum of twenty-five dollars, said attorney's fee to be paid into the general fund of the county.

Emergency. SEC. 3. Whereas, an emergency exists in that there is now no adequate provision for the burial of diseased animals, therefore this act shall take effect upon its passage and approval.

Approved March 7, 1899.

OKLAHOMA.

AN ACT to prevent the spread of hog cholera and other contagious diseases and prevent traffic in animals dying from infectious diseases.

Be it enacted by the Legislative Assembly of the Territory of Oklahoma:

Duty of owners. SECTION 1. That it shall be the duty of the owners of any swine or other domestic animals dying from cholera or other diseases, within twenty-four hours after their death, to cause the carcasses of such animals to be buried or burned up.

Disposition of carcass. SEC. 2. If any person shall barter, sell, or dispose of the carcass of any swine or other domestic animals infected with cholera

or other infectious diseases at the time of death to any person for the purpose of manufacturing the same into lard, soap, or for any other purpose, or if any person shall buy or otherwise obtain the carcass of any swine or other domestic animals infected with cholera or other infectious diseases at the time of death, for manufacturing purposes as aforesaid or any other purpose except that of burial or burning, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not to exceed fifty dollars or be imprisoned in the county jail not more than thirty days.

SEC. 3. It shall be unlawful for any person to sell or otherwise dispose of any live swine that is infected with cholera or any other contagious diseases; or to drive any such swine on the public highways after any such person or persons have received knowledge of any such contagious diseases; and any person violating the provisions of this act shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in any sum not to exceed fifty dollars or be imprisoned in the county jail not more than thirty days.

SEC. 4. This act shall be in force and effect from and after its passage and approval.

Approved March 9, 1899.

OREGON.

AN ACT to regulate the bringing of sheep from any other State or Territory into this State.

Be it enacted by the Legislative Assembly of the State of Oregon:

Certificate of inspection. **SECTION 1.** No person, company, or corporation shall bring or cause to be brought into this State any sheep or bands of sheep without first, and within three months prior thereto, obtaining from a sheep inspector, duly appointed and qualified under the laws of this State, a certificate of such inspector to the effect that the said sheep or bands of sheep have been personally inspected by such inspector, and that all such sheep are sound and healthy and free from scab or scabies or other infectious or contagious disease. It shall be the duty of any sheep inspector, upon the request of any person, to visit and inspect any band of sheep within his county or within five miles of the line of the State, unless he has inspected such band of sheep within three months prior thereto; and if at the time of such inspection said sheep are healthy and free from scab or scabies and all infectious and contagious diseases, he shall issue to the owner or person in charge thereof a certificate to that effect; and if not healthy and free from scab and scabies and all contagious and infectious diseases, he shall revoke any certificate which might have been issued by him, and the person holding such certificate shall forthwith on demand deliver the same to such inspector.

Quarantine. **SEC. 2.** Whenever the county court of any county has reason to believe that any disease mentioned in this act has become epidemic in certain localities in any other State or Territory, or that conditions exist that render sheep likely to convey disease, it must thereupon by order duly entered in its journal designate such localities, and prohibit the importation from such localities of any sheep into its county, except under such restrictions as are hereinafter provided.

Inspector to be notified of importations. **SEC. 3.** Upon the entry of such order of the county court of any county, the owners or persons in charge of any sheep which are intended to be brought into the said county from localities in any other State or Territory against which sheep quarantine has been declared, as provided in the next preceding section, must forthwith notify the sheep inspector of said county of such intention, and such owner or person in charge shall not allow any sheep to be brought into the county until said sheep have been quarantined and inspected by the sheep inspector as provided in the next succeeding section: *Provided*, That this section shall not apply to sheep being transported upon the railroad through the State of Oregon to points beyond the limits of said State, and which are not allowed to graze upon the public range of this State while being transported.

Duty of inspector. **SEC. 4.** Upon receiving notice of the intention of the owner or person in charge of any sheep, as provided in the last preceding section, to bring such sheep into any county of this State from any quarantine district, the sheep inspector of such county shall forthwith proceed to examine and inspect said sheep before they are brought into this State, and shall cause such

sheep to be kept within certain limits designated by him for a term of ninety days, and shall cause the owner or person in charge of such sheep to dip such sheep or otherwise treat such sheep for the disease prevalent in the quarantine district; and if at the expiration of said time the said sheep inspector shall find that said sheep are free from any contagious or infectious disease, he shall issue a certificate to the owner or person in charge of such sheep permitting them to be brought into this State.

Penalty. SEC. 5. Any person who fails to comply with or disregards any order or direction made by any sheep inspector under the provisions of this act, or who violates any of the provisions of this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof before a court of competent jurisdiction shall be punished by a fine of not less than \$50 nor more than \$500.

Penalty. SEC. 6. Any person, company, or corporation violating any provision of this act, or who shall fail to comply with or who disregards any order or direction made by any sheep inspector under the provisions of this act, shall be liable in a civil action for all damages sustained by any other person, company, or corporation in consequence of such violation. Such damage shall be a lien on the sheep, which may be sold to satisfy such lien as provided by law.

Emergency. SEC. 7. Inasmuch as there is great need for protection against the bringing of diseased sheep into this State, an emergency is hereby declared to exist, and this act shall take effect and be in force from and after its approval by the governor.

Approved February 18, 1899.

PENNSYLVANIA.

AN ACT to provide for the investigation of the diseases of domestic animals and making an appropriation therefor.

Appropriation and object of same. SECTION 1. That the sum of fifteen thousand dollars, or so much thereof as may be necessary, is hereby appropriated for the purpose of conducting investigations concerning the causes, nature, treatment, and prevention of the diseases of the domestic animals of the Commonwealth of Pennsylvania, with the object of discovering new facts which may be applied advantageously and profitably by the owners of live stock and those engaged in the care, use, and rearing of animals.

Investigation, who by. SEC. 2. That such investigation shall be made by and under the direction of the State Live Stock Sanitary Board, and the said board is hereby authorized to provide for and conduct such work of investigation as may be necessary to discover the most efficient, economical, and practical means of avoiding and suppressing the diseases of the domestic animals of this Commonwealth; and such work and the practical deductions therefrom shall, upon the order of the Secretary of Agriculture, be published as a part of the annual report of the Department of Agriculture, or as bulletins from said Department.

Expenses, how paid. SEC. 3. That all necessary expenses under the provisions of this act shall, after approval in writing by the Governor and the Secretary of Agriculture, to be paid by the State Treasurer upon the warrant of the Auditor General in the manner now provided by law, upon the presentation of specifically itemized vouchers.

In effect. SEC. 4. That this act shall take effect June first, one thousand eight hundred and ninety-seven.

Approved July 22, 1897.

UTAH.

AN ACT to amend section 2447, chapter 7, title 63, Revised Statutes of Utah, 1898, relating to the duties of the dairy and food commissioner.

Be it enacted by the Legislature of the State of Utah:

Contagious diseases; prosecution. SECTION 2447. It shall be the duty of the commissioner and he is hereby invested with the powers to enforce all laws that now exist or that may hereafter be enacted in this State.

* * * And said commissioner shall personally or by his deputy, when com-

plaint is made of the violation of any law relating to the feeding or keeping upon the premises for the purpose of feeding, any unwholesome food for cattle, or the keeping of cattle afflicted with any contagious or infectious disease, immediately investigate said charge and shall at once prosecute or cause to be prosecuted any person or persons, firm or firms, corporation or corporations violating any of the laws of this State which it is the duty of said commissioner to enforce.

Approved March 9, 1899.

AN ACT to prevent persons selling or furnishing milk or dairy products from keeping cattle having tuberculosis or other contagious or infectious diseases.

Be it enacted by the Legislature of the State of Utah:

Diseased cattle prohibited. SECTION 1. No person selling, exchanging, furnishing, or delivering milk or dairy products shall have in his possession, at any place where milch cows are kept, any cattle having tuberculosis or other infectious or contagious disease.

Diseased animals to be killed. SEC. 2. It shall be the duty of the dairy and food commissioner of this State, in case he shall find that cattle are kept in violation of the provisions of this act, to cause all such cattle, having any contagious or infectious disease, to be killed.

Penalty. SEC. 3. Any person violating the provisions of this act shall be guilty of a misdemeanor.

SEC. 4. This act shall take effect upon approval.

Approved March 9, 1899.

WEST VIRGINIA.

AN ACT to prevent the spread of contagious diseases among domestic animals.

Be it enacted by the Legislature of West Virginia:

That chapter 9 of the acts of 1897 be amended and reenacted and additional sections added thereto so as to read as follows:

Quarantine. 1. That when it shall be brought to the notice of the president of the State board of agriculture that any contagious or infectious disease, not otherwise provided for by law, prevails among domestic animals, he shall take such measures to prevent its spread as may be deemed expedient, and for this purpose shall have power to place infected animals, herds, buildings, and farms in quarantine, and to prevent the movement of animals or objects likely to convey the contagion, except upon proper permits; and with the consent and approval of said board, to make such rules and regulations for the government of such quarantine as may be deemed necessary to effectively carry out the provisions of this act.

Interfering with officer; violating quarantine; penalty. 2. That any person or persons who shall willfully or intentionally interfere with any officer or officers duly authorized to carry out the provisions of this act, or who shall willfully or intentionally violate the provisions of the quarantine authorized by section 1 of this act, shall be deemed guilty of a misdemeanor, and upon conviction shall be liable to an imprisonment not exceeding three months or a fine not exceeding \$100 or both at the discretion of the court.

Inspection and report. 3. That when, in the judgment of the president of the board, public interest and safety demand it, he may give written authority to any consulting veterinarian of the board, who shall be a graduate of some reputable veterinary college, or he may go in person, taking such veterinarian with him, to examine any animal or animals or any buildings or farms suspected, and the decision of such veterinarian or the president of the board and the veterinarian acting together, after proper examination, and under the provisions of this act, and such rules and regulations as the board may prescribe, shall be final, and the veterinarian or president of the board and the veterinarian acting together shall proceed to quarantine, to destroy, to order burned or buried, or to take any other action authorized by this act and the rules of said board. It is hereby made the duty of the veterinarian having charge of any case or the president and veterinarian acting together to make a full and complete report of the same in writing to the secretary of said board, under such rules and in such form as may be by it required.

Compensation. For such services the president and veterinarian shall each receive a per diem of \$4 per day and actual expenses while so engaged, which shall be paid out of current appropriations made for the enforcement of this act and on order signed by the president and secretary of the board.

Appraisement and compensation. 4. That when it shall be found necessary and expedient to kill any animal or animals to prevent the spread of contagious or infectious diseases, it or they shall first be appraised by three disinterested and sworn appraisers, who shall have due consideration for the actual condition of the animal or animals at the time of appraisement, and the owner or owners of such animal or animals so destroyed shall be entitled to receive from the secretary of the board of agriculture a certificate of value, as appraised by said appraisers, subject to the consent and approval of the said board. For such services each appraiser shall each receive a per diem of \$1 per day, to be paid out of current appropriations made for the enforcement of this act and on order signed by the president and secretary of the said board.

Certificates, how paid. 5. That at the end of each fiscal year the holders of such certificates of value issued by the secretary of said board shall be paid the same from current appropriations made for the purpose. *Provided*, That the amount to be paid on such certificates in any one year shall not exceed the sum of \$3,000, which amount shall be paid pro rata at the end of each fiscal year on order signed by the president and secretary of the State board of agriculture.

Cooperation with general government. 6. That for the economical eradication of contagious or infectious diseases of domestic animals the president of the State board of agriculture shall have power, with the consent and approval of said board, to arrange for and carry into effect terms of cooperation with the proper officers of the national Government.

5. That all acts or parts of acts inconsistent herewith are hereby repealed.
Approved February 24, 1899. In effect 90 days from passage.

TEXAS.

AN ACT to amend Article 5043, Chapter 6, Title 102, Revised Statutes, as amended by the Twenty-fifth Legislature, in Chapter 121 of said acts, relating to inspection of live stock, so as to place Randall County under the operation of said law, and to remove Cochran, Cottle, Bailey, Farmer, Lamb, and other counties from the operation of said law.

Be it enacted by the Legislature of the State of Texas.

Concerning inspection of hides. SECTION 1. That Article 5043, Chapter 6, Title 102, Revised Statutes, as amended by the Twenty-fifth Legislature, in Chapter 121 of said acts, be so amended as to read as follows, to wit:

ARTICLE 5043. The counties of Anderson, Austin, Angelina, Atascosa, Bell, Bowie, Brazos, Bastrop, Bosque, Burleson, Brazoria, Burnet, Caldwell, Camp, Calhoun, Cass, Chambers, Cherokee, Collin, Colorado, Cooke, Delta, Ellis, El Paso, Erath, Fannin, Franklin, Falls, Freestone, Gonzales, Eastland, Stephens, Fayette, Fort Bend, Galveston, Goliad, Grayson, Gregg, Grimes, Hardin, Harrison, Hays, Henderson, Hill, Hood, Hunt, Hopkins, Houston, Jackson, Dewitt, Jasper, Jefferson, Johnson, Kaufman, Lamar, Lee, Leon, Lampasas, Maverick, McLennan, Madison, Marion, Montgomery, Montague, Morris, Nacogdoches, Newton, Orange, Panola, Parker, Polk, Palo Pinto, Rains, Red River, Robertson, Rockwall, Rusk, Sabine, San Augustine, San Jacinto, Shackelford, Shelby, Smith, Titus, Trinity, Tyler, Upshur, Van Zandt, Walker, Washington, Wharton, Wise, Wood, Jack, Harris, Clay, Young, Limestone, Wheeler, Lavaca, Nueces, Bee, Refugio, San Patricio, Somervell, Matagorda, Waller, Karnes, Victoria, Milam, Live Oak, Williamson, Liberty, Guadalupe, Gillespie, Baylor, Knox, Archer, Hardeman, Childress, Hall, Denton, Collingsworth, Donley, Gray, Armstrong, Briscoe, Floyd, Kendall, Comal, Navarro, Brown, Coryell, Hamilton, Mills, Duval, Comanche, Bailey, Dallam, Oldham, Hartley, Hockley, Cochran, Wilson, Ford, Mason, Throckmorton, Menard, and Tarrant are hereby exempt from the operation of this act, and the provisions of the same shall in no wise relate or apply to the aforesaid counties; *provided*, that in those counties bordering on the line of the State, except those bordering on Red River and the Rio Grande, when there is a depot or place for the shipment of cattle, no inspector of hides and animals shall be elected, but one for each of said counties shall be appointed by the Governor, who shall hold office for two years and until his successor shall be appointed; and said inspector so appointed to take the constitutional oath of office and give the

bond now required of inspectors of hides and animals, and such inspectors receive the same fees now allowed inspectors of hides and animals, and the same duties; *provided*, the inspectors shall be elected in the counties of Armon, Hidalgo, Starr, Zapata, and Webb; *provided*, That such cattle shall be subject to inspection on board of any railroad unless the same have been on board of such train for the purpose of evading the provisions of this act; *provided further*, That the counties of Limestone, Fayette, Lavaca, Gonzales, Colorado, Bell, Calhoun, Hays, Caldwell, Blanco, Llano, Kendall, Comal, Lampasas, Austin, Johnson, Hill, Ellis, Jackson, Victoria, Dewitt, Freestone, Hamilton, Williamson, Milam, Live Oak, Harris, Bosque, Erath, Hood, Somervell, Coryell, Lampasas, Mills, Wichita, Wilbarger, Hardeman, Gray, Armstrong, Briscoe, Floyd, Cottle, Hemphill, Fannin, Camp, Childress, Hall, Collins, Donley, Delta, Franklin, Hopkins, Hunt, Wilson, Navarro, Guadalupe, Garza, Baylor, Throckmorton, Wharton, and Knox, shall be exempt from all laws relating to inspection of hides; and *provided further*, that the provisions of this act and chapter shall in no wise relate or apply to the counties of Oldham, Dallam, Parmer, Bailey, Lamb, Hemphill, Cottle, Hardeman, Maverick, Cochran; that all laws and parts of laws in conflict with the provisions of this act are hereby repealed.

In effect 90 days after adjournment.

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